education

Department:
Education
REPUBLIC OF SOUTH AFRICA

LIFE SCIENCES

EXAMINATION GUIDELINES

GRADE 12

2009

This guideline consists of 26 pages.

INDEX

1. INTRODUCTION

This adapted Examination Guideline for 2009 and 2010 is designed to provide clarity on the changes approved by the DoE on what should be taught, learned and assessed in Grade 12. This document replaces the Examination Guidelines for Life Sciences dated 2008.

This examination guidelines consists of the following:

1.1 The composition and format of the question papers
1.2 The weighting grids for the ratios between the Learning Outcomes per question papers
1.3 The weighting grids for the ratios between the knowledge areas per paper
1.3 Clarifying each assessment standard in each learning outcome. (Spells out the skills that should be assessed to demonstrate the achievement of the particular assessment standards)
1.4 The scope and depth of the content to be assessed. The changes/additions are indicated in bold.

2. THE FORMAT OF BOTH QUESTION PAPERS FOR THE *END-OF-YEAR EXAMINATIONS (AS WELL AS THE TRIAL EXAMINATIO)*

The format of both question papers are the same and all questions are compulsory. The duration of the question papers is 2½ hours each.

SECTION	DESCRIPTION	MARKS
A	➢ Consists of a variety of question types such as multiple-choice questions, terminology, matching items, diagrams, etc.	50
B	➢ Consists of two questions which assess a variety of skills and competences. ➢ Questions may have sub-questions. ➢ Questions may be based on data in various forms, paragraphs, drawings, etc.	60 (2 x 30)
C	➢ The first part to this section consists of one question based on a case study or questions based on data analysis and interpretation. ➢ The second part consists of an mini-essay. ➢ While the essay should focus on Learning outcome 3, it should also assess the other Learning outcomes	40

3. THE RATIO BETWEEN THE THREE LEARNING OUTCOMES

The ratio between the three Learning Outcomes for each question paper.

LO1	LO2	LO3
40%	40%	20%

4. THE RATIO BETWEEN THE COGNITIVE LEVELS

The ratio between the cognitive levels for each question paper.

Categories	A (Basic Knowledge)	B (Comprehension)	C (Application)	D Evaluation and synthesis)
Weighting (%)	20%	40%	30%	10%

5. WEIGHTING GRID SHOWING THE RATIO BETWEEN THE DIFFERENT KNOWLEDGE AREAS

Question Paper	Paper 1		Paper 2	
Knowledge Area	Tissues, Cells & Molecular Studies	Structure, Control And Processes	Environmental Studies	Biodiversity, Change & Continuity
Topics	DNA, Protein synthesis & Genetics	Reproduction in Humans and Plants	Local Environmental Issues & Effects of Pollutants on Humans	Early Theories of Evolution, Evidence, Mass Extintions, & Human Origins
Weighting (%)	**60%**	**40%**	**50%**	**50%**

6. UNPACKING THE ASSESSMENT STANDARDS

Table 1: LO 1 - SCIENTIFIC INQUIRY AND PROBLEM SOLVING SKILLS

	GRADE 12	Elaboration
Assessment Standard 1 The learner identifies and questions phenomena and plans an investigation	• ***Generate and question hypothesis based on identified phenomena for situations involving more than one variable*** • ***Design tests and/or surveys to investigate these variables***	**Experimental design** **Identify and question phenomena** ▪ Through observation identify phenomena and formulate a question ▪ List all possible variables (factors) ▪ Formulate a hypothesis (prediction) that follows the criteria - Explain all aspects of an observation - Use the simplest possible explanation - Be expressed in such a way that predictions can be made from it - Be testable by experiment **Plan/Design an investigation without instructions** ▪ Identify the variable to be tested (dependent variable) ▪ **Identify the independent variable** ▪ **Identify other factors that need to be kept constant** ▪ List appropriate apparatus ▪ Plan sequence of steps ▪ Set appropriate control **Evaluate the experimental design** ▪ Identify advantages and limitations of experimental design
Assessment Standard 2 The learner conducts investigations by collecting and manipulating data	• ***Compare instruments and techniques to improve the accuracy and reliability of data collection*** • ***Manipulate data in the investigation to reveal patterns*** • ***Identify irregular observations and measurements***	**Collecting data** ▪ Select instrument/method that is most appropriate for collection of data in an investigation ▪ Scaling, measuring quantities, systematic counting, matching, differentiating, describing objects / mechanisms/ processes, taking pictures, identifying problems and causes ▪ Identify factors that can influence your reliability and validity **Recording results/ findings** ▪ Record results in the form of tables, drawings, descriptions, pictures, etc. ▪ Identify patterns in the results ▪ Identify and record irregular observations

	• ***Allow for irregular observations and measurements when displaying data***	**Re-organise data** ▪ Plotting graphs (line, bar graphs, histograms and pie charts) ▪ Constructing flow charts ,mind maps ,and concept maps, etc. ▪ Identify patterns/relationships in the data
	GRADE 12	**Elaboration**
Assessment Standard 3 The learner analyses, synthesises, evaluates data and communicates findings	• ***Critically analyse, reflect on and evaluate the findings*** • ***Explain patterns in the data in terms of knowledge*** • ***Provide conclusions that show awareness of uncertainty in data.*** • ***Suggest specific changes that would improve the techniques used.***	**Analysing and evaluate findings** ▪ Explain the relationship between the variables (how and when the dependent variable changes over time/concentration changes) (pH, light, carbon dioxide, etc.) during the experiment ▪ Identifying and explaining trends/patterns from graphs (line graphs, histograms, bar graph and pie charts) flow charts, descriptions, etc. ▪ Doing calculations ▪ Identifying and explaining anomalous results ▪ Comparing data (similarities and differences) ▪ Critically analyse **Make deductions/conclusions that:** ▪ Explain the data ▪ Acknowledge uncertainty in data **Improve the experimental design** ▪ Suggest specific changes that could improve the apparatus and technique

Table 2: LO 2 – CONSTRUCTION AND APPLICATION OF LIFE SCIENCES KNOWLEDGE

	GRADE 12	Elaboration
Assessment Standard 1 Accessing knowledge	• ***Use various methods and sources to access relevant information from a variety of contexts***	▪ Use various methods and sources to access information ▪ Access information from a variety of contexts (for example cloning) from different perspectives – religious, cultural and scientific ▪ Use the index to identify the relevant parts from various sources ▪ Evaluate the content from which to select key ideas from the various sources ▪ Use statistical and graphical data, e.g. tables and graphs to access information ▪ Use various resources such as reference books, textbooks, internet, experts, teachers, peers, newspapers and magazines
Assessment Standard 2 Interpreting and making meaning of knowledge in Life Sciences	• ***Interpret, organise, analyse, compare and evaluate concepts, principles, laws, theories and models and their application in a variety of contexts***	▪ Interpret – making sense by understanding the concept ▪ Organise and analyse – by describing and explaining in own words by using flow charts, diagrams, mind maps, paragraphs, etc. ▪ Compare and evaluate concepts, for example alternative theories of evolution ▪ Apply different concepts, principles, laws, theories or models and alternate explanations in a variety of contexts, for example the concept of surrogacy's in terms of religion, ethics and scientific contexts
Assessment Standard 3 Showing an understanding of the application of Life Sciences knowledge in everyday life.	• ***Evaluate and present an application of Life Science knowledge***	▪ List ways in which Life Sciences knowledge can be both useful and detrimental ▪ Make decisions/Suggest solutions based on an evaluation of the useful and detrimental effects of Life Sciences knowledge ▪ Communicate through debates, posters, essays, etc. on the application of Life Sciences knowledge

Table 3: LO 3 – LIFE SCIENCES, TECHNOLOGY, ENVIRONMENT AND SOCIETY

<table>
<tr><th></th><th>GRADE 12</th><th colspan="2">Elaboration</th></tr>
<tr><td rowspan="2">Assessment Standard 1
Explore and evaluating scientific ideas of past and present cultures</td><td rowspan="2">• Critically evaluate scientific ideas and indigenous knowledge of past and present cultures</td><td>Scientific ideas:
Scientific - conforming with the methods used in science
Ideas - products of mental activities

▪ Scientific ideas (science methods)
▪ Testing the ideas
▪ investigations
▪ Peer review
▪ Verification by science community
▪ Conferences
▪ Scientific journals
▪ Acceptance by science community – theory</td><td>Indigenous knowledge

▪ Indigenous knowledge (not necessary scientific methods)
▪ "Testing" the ideas
▪ from generation to generation
▪ Peer review
▪ Verification by general community
▪ From generation to generation - verbal communication
▪ Acceptance by community</td></tr>
<tr><td colspan="2">▪ Compare the scientific approach and traditional approach and ways in which each has changed in, for example, the treatment of diseases.
▪ Compare the advantages and limitations of indigenous knowledge and scientific ideas of present and past cultures, example modern and traditional remedies.
▪ Generate a hypothesis, design test/variables.</td></tr>
<tr><td>Assessment Standard 2
Comparing and evaluating the uses and development of resources and products, and their impact on the environment and society</td><td>• Analyse and evaluate different ways in which resources are used in the development of biotechnological products and make informed decisions about their use and management in society for a healthy, sustainable environment</td><td colspan="2">▪ Comparing, analysing and evaluating the ways in which resources are used.
▪ Comparing, analysing and evaluating the development of biotechnological products.
▪ Explain the impact of resource utilisation and biotechnological product development on the environment.
▪ Explain impact of resource utilisation and biotechnological product development on society for a sustainable and healthy environment.
▪ Make informed decisions.</td></tr>
<tr><td>Assessment Standard 3
Comparing the influence of different beliefs, attitudes and values on scientific knowledge</td><td>• Critically evaluate and take a justifiable position on beliefs, attitudes and values that influence developed scientific and technological knowledge and their application in society.</td><td colspan="2">▪ Compares and evaluates the influence of different beliefs in the interpretation of scientific knowledge and its application to society, e.g. stem cells, cloning, contraception, sperm bank, surrogacy, abortion, etc. Take a position, and substantiate.
▪ Compares and evaluates the influence of different attitudes and values in the interpretation of scientific knowledge and its application to society.
▪ Debates and argues the strengths and limitations of different beliefs, attitudes and values in the interpretation of scientific knowledge and its application to society.</td></tr>
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7. SCOPE OF THE PRESCRIBED CONTENT

TISSUES, CELLS AND MOLECULAR STUDIES – 7 weeks

DNA and protein synthesis

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Structure and functions of the nucleus	❑ Revise the following functions of the nucleus (from Grade 10): • Control structure and metabolism of cell • Provides mechanism, through cell division, for transmission of hereditary characteristics ❑ Identify, describe and state the functions of the following parts of the nucleus: • Nuclear envelope with pores • Nucleoplasm • Chromosomes (chromatin network) • Nucleolus (manufacturing of ribosomal RNA)
DNA	❑ Identify DNA and RNA as nucleic acids. ❑ State that nucleotides are building blocks of nucleic acids. ❑ Name three components of a nucleotide: • Nitrogenous bases linked by hydrogen bonds • Sugar portion (deoxyribose in DNA; ribose in RNA) • Phosphate portion ❑ Study the structure of DNA with regard to the following: • State the location of DNA (nuclear and mitochondrial) • Name 4 nitrogenous bases of DNA: adenine (A), thymine (T), cytosine (C), guanine (G) • State that pairing of bases in DNA occur as follows: (A : T and G : C) • Draw stick drawing representing a portion of the structure of a DNA molecule (in a ladder-like form) • Identify double helix configuration, hydrogen and sugar-phosphate bonds of DNA ❑ State the functions of DNA. ❑ Describe the history of the discovery of the DNA molecule **(refer to Watson, Crick and Franklin)**. ❑ Conduct practical work on the extraction of DNA using household detergents. ❑ Make a model of DNA. ❑ Describe DNA replication under the influence of enzymes (no names of enzymes required). ❑ State the significance of DNA replication. ❑ Explain DNA finger-printing with respect to the following: • What it is • Its uses • Debates around its usage (costs, ethical considerations, consequences of interpretation errors) ❑ Describe the role of bacterial DNA in the manufacture of insulin (biotechnology).

CONTENT	ELABORATION/SUGGESTED SEQUENCE
RNA	❑ Name the three types of RNA and state the location of each. ❑ State that RNA is a single stranded structure consisting of nucleotides: Each nucleotide is made up of a sugar (ribose), phosphate and nitrogen base. ❑ Name the 4 nitrogenous bases of RNA: adenine (A), uracil (U), cytosine (C), guanine (G). ❑ Make a stick drawing of a portion of a RNA molecule. ❑ State the functions of RNA. ❑ Compare (differences and similarities) between DNA and RNA.
Protein synthesis	❑ State that proteins are made of amino acids and that the sequence of the amino acids determines the type of protein. ❑ Describe the role of DNA and RNA in protein synthesis through a discussion of the following: • Formation of mRNA from DNA by transcription • Movement of mRNA from the nucleus to cytoplasm • Translation of mRNA (codon) to form a protein using tRNA (anticodon) ❑ Determine the sequence of amino acids required to form a protein from a given mRNA sequence and a list of amino acids carried by different tRNA molecules

Chromosomes, meiosis and the production of sex cells

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Chromosomes	❑ State the location of chromosomes. ❑ State that a chromosome consists of genes made up of DNA and protein. ❑ State that the number of chromosomes in a cell is a characteristic of an organism (for example humans have 46 chromosomes). ❑ List the functions of chromosomes. ❑ Explain why chromosomes may appear as single strands or double stranded (two chromatids joined by a centromere). ❑ Explain what is meant by haploid and diploid number of chromosomes. ❑ Differentiate between sex cells (gametes) and somatic cells (body cells).

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Meiosis	❑ Review mitosis (Grade 10). ❑ Define meiosis. ❑ State where meiosis takes place in plants and in animals. ❑ Briefly outline the life cycle of humans to show the role of mitosis and meiosis in restoring and maintaining the chromosome number. ❑ Outline the different stages in the cell cycle with an emphasis on the events of interphase. ❑ Using diagrams identify and state what happens in each of the following phases of meiosis. • First Division: 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: 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) ❑ Explain why the four cells at the end of meiosis are not genetically identical. ❑ Compare the first and second meiotic divisions. ❑ Explain the importance of meiosis: • In the reduction of chromosome number • As a mechanism to introduce genetic variation through o Crossing-over during Prophase 1 o The random arrangement of chromosomes along the equator during Metaphase 1 ❑ Study microscope slides/micrographs/models showing various phases of meiosis.

Genetics

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Introduction	❑ Define genetics. ❑ Explain the following terms: • *Genes* as small portions of DNA and protein • *Alleles* as genes controlling same characteristic example eye colour • *Haploid* • *Diploid* • *Somatic/body cells* (containing genes in pairs) • *Sex cells/gametes* (containing unpaired genes) • *Homozygous* • *Heterozygous* • ***Dominant*** • ***Recessive*** • *Human genome*
Monohybrid Crosses	❑ Outline Mendel's contribution to genetics as follows: • Mendel's experiments • **Mendel's concept of dominance and law of segregation** ❑ Explain Mendel's monohybrid cross in terms of genes, dominant , recessive, homozygous, heterozygous, genotype, phenotype and filial generations (using diagrams and Punnet's squares). ❑ Conduct a simulation of a monohybrid cross using pieces of coloured paper, coloured beads or coloured seeds. ❑ Solve monohybrid problems based on complete dominance (up to 2nd generation). ❑ 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) ❑ Solve monohybrid problems based on incomplete and co-dominance (up to 2nd generation).
Dihybrid Crosses	❑ State what is meant by a dihybrid cross. ❑ Use an example to illustrate a dihybrid cross of complete dominance.
Sex-determination	❑ Differentiate between autosomes and sex chromosomes in the karyotype of human males and human females. ❑ Use a monohybrid cross to show the inheritance of sex in humans.
Inheritance and prediction of blood groups	❑ Explain the inheritance of the four blood groups (phenotypes) and their possible gene combinations (genotypes) using the alleles **I^A, I^B and i**. ❑ Predict possible blood groups of children from parents with various blood groups. ❑ Explain the importance of the prediction of blood groups in solving problems of disputed parentage as compared to DNA analysis.

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Mutations	❑ Describe mutations as follows: (link with evolution, later) • Gene **and chromosome** mutations as **changes** in the copying process during DNA replication • **Differentiate between point and frameshift mutation (including deletion, insertion, inversion)** • **Differentiate between addition or deletion of a chromosome and addition of a set of chromosomes** • Causes of mutations • Define natural selection and describe the role of mutations in natural selection
Genetic disorders	❑ Describe the nature, causes and symptoms of the following diseases: • Down's syndrome • Sickle –cell anaemia • Haemophilia • Albinism ❑ Make interpretations on given karyotypes of organisms.
Genetic Modification	❑ Explain what is meant by selective breeding and list advantages of this process. ❑ Explain what is meant by genetic modification. ❑ Briefly describe each of the following with regard to genetic modification: • Production of human insulin using bacteria (done earlier under DNA) • The creation of an animal that looks like the extinct quagga • The advantages and disadvantages of genetically modified foods • Various viewpoints on cloning
Pedigrees and genetic counselling	❑ Interpret pedigree diagrams to trace the inheritance of characteristics over many generations. ❑ Explain how pedigree diagrams can be used in: • Predicting the characteristics of offspring • Selective breeding • Genetic counselling

STRUCTURE, CONTROL AND PROCESSES

Reproduction

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Introduction	❑ Draw a flow diagram to outline the human life cycle. ❑ Explain the role of meiosis and fusion in the life cycle of humans.
Structure of the male and female reproductive systems of humans	❑ Study of the male and female reproductive systems of mammals using charts, models and/or a small dissected mammal. ❑ The male reproductive system. • Briefly describe the testes under the following: o Position o Internal structure to show cells of Leydig, germinal epithelium, cells in different stages of spermatogenesis including spermatogonia, Sertoli cells o Functions of germinal epithelium, cells of Leydig, Sertoli cells • Identify on a diagram the tubes responsible for carrying spermatozoa: epididymis, vas deferens. ejaculatory ducts and urethra and state the functions of each part. • Identify on a diagram the accessory glands: seminal vesicles, prostate glands and Cowper's glands and state the functions of each. • Briefly describe puberty and the development of the secondary male characteristics under the influence of testosterone. ❑ The female reproductive system. • Briefly describe the ovaries under the following: o Position o Internal structure to show germinal epithelium, Graafian follicles in different stages of development with ova, and corpus luteum o Functions of germinal epithelium, Graafian follicles and corpus luteum • Identify on a diagram the: o Fallopian tubes with ciliated funnels and state the functions of each part o Uterus with uterine wall lined by endometrium, and state the functions of each part o Vagina and its external opening, the vulva, and state the functions of each part • Briefly describe puberty and development of the female characteristics, under the influence of oestrogen and progesterone.

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Gametogenesis (Formation of male and female sex cells)	❑ Review the main events of mitosis and the halving of the chromosome number during meiosis. ❑ Describe spermatogenesis as follows: • Cells from the germinal epithelium lining the semeniferous tubules undergoes meiosis • 4 haploid spermatids are formed • Each spermatid matures to form a spermatozoan ❑ Draw and label the structure of a spermatozoon and state the function of each part (acrosome, head with nucleus, middle portion with mitochondria and a tail). ❑ Study prepared microscope slides of the section through a testis. ❑ Describe oogenesis as follows: • Follicles develop from the germinal epithelium in the ovary • One cell in the follicle enlarges and undergoes meiosis • Of the 4 cells that result, only one survives to become a mature ovum ❑ Draw and label the structure of an ovum and state the function of each part (layer of jelly, nucleus, cytoplasm). ❑ Study prepared microscope slides of the section through an ovary.
Ovulation and Menstruation	❑ Describe the ovarian cycle by referring to: • Young Graafian follicles in various stages of development • Mature Graafian follicle • Ovulation • Transformation into corpus luteum • Hormonal control ❑ Describe the uterine cycle by referring to the changes that take place in the in the wall of the uterus until the endo-metrium tears away accompanied by bleeding (menstruation). ❑ Describe the hormonal control of the ovarian and uterine cycle by referring to the action of FSH, oestrogen, LH and progesterone.

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Fertilisation and Implantation	❑ Define copulation and fertilisation and describe how and where fertilization takes place. ❑ Describe the development of the zygote into a blastocyst and then into an embryo. ❑ Describe implantation, including the role of progesterone in maintaining pregnancy.
Gestation	❑ Briefly describe the change in size and shape of the embryo until it becomes a foetus. ❑ Identify and state the role of the following parts of the developing embryo: • The chorion and chorionic villi • The amnion, amniotic cavity and amniotic fluid • The umbilical cord and placenta ❑ Identify the main parts of the embryo and extra-embryonic membranes in the uterus in a diagam. ❑ Briefly describe the three stages of the natural birth process and the action of the hormones oxytocin and prolactin. ❑ Briefly describe birth by Caesarean section. ❑ Briefly describe ante-natal care including the following: • Sensible diet • Avoidance of alcohol and other drugs; foetal alcohol syndrome: its symptoms and prevention • Working and leave-taking • Exercise • Medical care, including amniocentesis and ultra-sound scans ❑ Briefly describe post-natal care: • Parental responsibility (parent as protector, provider and potential threat) ❑ State the advantages of breast–feeding compared to formula milk ❑ Briefly describe multiple births through a discussion of the following: • Fraternal twins • Identical twins, including Siamese twins • Effect of fertility drugs on multiple births

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Control of human fertility	❑ State what is meant by birth control/ contraception and describe briefly each of the following methods: • Natural methods o Withdrawal o Rhythm method, including details of "safe", "less safe" and "unsafe" days to have sexual intercourse • Barrier methods o Condom o Loop or IUD o Femidom o Diaphragm • Chemicals o Spermicides o The contraceptive pill o Contraceptive Injections • Surgical methods o Vasectomy o Tubal ligation ❑ Infertility • Describe causes of infertility. • Briefly describe each of the following methods to improve fertility: o Fertility drugs o Artificial insemination, including use of sperms from sperm banks o In-vitro fertilisation (test tube babies) o Gamete Intra-fallopian Transfer (GIFT) o Surgery

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Technology in reproduction	❑ Describe each of the following as it relates to reproduction: • Stem cell research • Amniocentesis • Ultrasound used to determine the sex of the child ❑ Discuss ethics, beliefs and attitudes towards the above.
Sexually Transmitted Diseases	❑ Describe the causes, transmission, symptoms and treatment and prevention of : • Syphilis • Gonorrhoea ❑ With regard to HIV/Aids: • Describe the causes, transmission, symptoms, testing and treatment, and prevention of the disease • Discuss the latest statistics on the disease • Discuss ethics, beliefs and attitudes about HIV/AIDS and sex
Cancer of Parts of the Reproductive System	❑ Briefly describe the causes, symptoms and treatment of cancer of any one of the following: • Breast • Cervix • Prostate gland
Reproduction in Plants	❑ Differentiate between asexual and sexual reproduction in plants. ❑ Briefly describe asexual reproduction: • By means of spores • By vegetative reproduction ❑ Describe sexual reproduction in angiosperms under the following headings: • Simple structure of a dicotyledonous flower • The structure of the male gametophyte • The structure of the female gametophyte • Pollination and development of the pollen tube • Double fertilisation • Development of the fruit and seed • Seed dispersal and germination ❑ Describe how sexual and asexual reproduction in plants produce food.

ENVIRONMENTAL STUDIES

Local environmental issues	
CONTENT	**ELABORATION/SUGGESTED SEQUENCE**
Introduction	❑ Explain the following concepts studied in Grades 10 and 11 in a local environment: • Ecosystem • Environment • Biotic and abiotic components • Interactions between the biotic and abiotic components such as food chains, food webs and energy flow, competition and predation ❑ Explain extinction and loss of biodiversity (studied in Grades 10 and 11) as it relates to local indigenous resources by focussing on: • Threats to biodiversity • Categories of organisms which are extinct or threatened with extinction • Examples of South African organisms which are extinct or threatened with extinction • Review of the Red-data listing
South African resources	❑ List some South African natural resources: • Plants (Devil's claw, rooibos, fynbos and African potato, etc.) • Animals (perlemoen, fish, game, etc.) • Minerals (coal, oil, etc) • Land
Exploitation of South African natural resources	❑ Describe why exploitation of resources takes place. ❑ Describe the value of sustaining natural resources. ❑ Discuss the cause and effect of overexploitation and corrective management actions for each of the following: • Resources for food: o Exploitation of fish or perlemoen o Exploitation of at least one other example in your local environment • Resources for medicinal purposes (Western and Traditional): o Exploitation of any one resource such as Devil's claw, Rooibos, Hoodia, African potato, or the Rhinoceros horn

Effect of pollutants on human physiology and health

Introduction	❑ State that pollution is any undesirable change in the physical, chemical or biological characteristics of air, water or land. ❑ Differentiate between degradable and non-degradable pollutants using examples. ❑ List types of pollution: air, water, soil (land) and provide examples of the pollutant in each case.
Air pollution	❑ List major air pollutants (carbon dioxide, carbon monoxide, sulphur dioxide, pesticides, lead, chlorine and asbestos). ❑ Investigate the air pollutant(s) in your local environment. • Describe its effects on human physiology and health (asthma, allergies, cancer). • Discuss solutions to the challenges of air pollution. • Discuss legal and ethical issues around air pollution.
Water pollution	❑ List sources of water pollution (sewage, industrial wastes and use of detergents). ❑ Investigate the water pollutant(s) in your local environment. • Describe its effects on human physiology and health (gastro enteritis, cancer, typhoid and allergies). • Discuss solutions to the challenges of water pollution. • Discuss legal and ethical issues around water pollution.
Soil/Land pollution	❑ List sources of soil pollution (sewage, industrial wastes, radioactive wastes from nuclear plants, fertilisers and non-degradable solid wastes). ❑ Investigate the soil pollutant(s) in your local environment. • Describe its effects on human physiology and health (cancer, food poisoning) . • Discuss solutions to the challenges of soil pollution. • Discuss legal and ethical issues around soil pollution.
Waste management	❑ Investigate the management of waste (solid waste, sewage) under the following headings: • Responsibility • Effect on biotic and abiotic components • Legal and ethical issues

BIODIVERSITY, CHANGE AND CONTINUITY

Early theories of evolution

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Introduction	❑ Review the nature of science. ❑ Distinguish between what is a fact, hypothesis, theory, model, law and purpose (spiritual value) of life. ❑ Define the terms population and a species. ❑ Explain what is meant by diversity and how the discovery of new species increases biodiversity. ❑ Explain what is meant by extinction and how this leads to a decrease in biodiversity. ❑ State that evolution may lead to increased diversity or to extinction of species.
Early theories of evolution **Jean Baptiste de Lamarck (1744 – 1829)**	❑ Describe the following two "laws" of the Lamarck. • "Law" of use and disuse • "Law" of inheritance of modified characteristics ❑ **Describe** examples of the application of the Lamarck's theory **such as in the long neck of giraffe, the legs of snakes, etc**. ❑ Explain **why** the Lamarck's theory is not accepted by most life scientists today since: • There is no evidence to show that changes brought about by adaptation to environment are inherited from parent to offspring • **Lamarck believed in determinism (internal drive of organisms to change)**
Charles Darwin (1809-1882)	❑ Describe Darwin's Theory of Evolution by Natural Selection in terms of: • The historical development: o 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 **such as tortoises, finches, etc.** o Publication of Darwin *On the Origin of the Species* in 1859 • Observations on which Darwin based his theory: o Offspring of the same species produce a large number of offspring o **Variations within species** o Of the large number of offspring produced, only a few survive o Survival of organisms as a result of natural selection. Conduct a practical activity to show the variation that exists within the offspring of a species and that not all offspring survive for e.g. 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. ❑ Outline differences between de Lamarck and Darwin's theories

Explanation of evolution in terms of current knowledge

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Introduction	❑ State that current knowledge of evolution supports Darwin's ideas and in addition: • Provide explanations for Darwin's observations of variation of offspring e.g. finches of Galapagos • Makes a distinction between micro-evolution, speciation and macro-evolution • Attempts to provide explanations for mass extinctions • Provides "evidence" for evolution .
Variation as an explanation for evolution	❑ State that phenotypic variation is a result of genetic variation e.g. finches of Galapagos, cheetah or the white lion. ❑ Explain the role of each of the following as sources of variation: • Meiosis (crossing over and random arrangement of chromosomes) • Mutations **(gene and chromosome)** at cellular and molecular level (lethal, neutral or fixed mutations) • Reproduction (random fusion of gametes) ❑ Choose TWO examples (one human and one non-human) to illustrate the practice of inbreeding and outbreeding in population, e.g. plants, animals and humans by looking at advantages and disadvantages of each. ❑ Using examples, explain how variation over a period of time can lead to: • Micro-evolution (variation within a species) • Speciation (formation of new species at ecological, reproductive and genetic level) • **ONE example of allopatric and ONE example of sympatric speciation** • Macro-evolution (patterns, trends and rate of change among lineages over geological times)
The geological time scale	❑ Describe the geological time scale in terms of: • The need for the geological time scale • The structure of the geological time scale • The three eras: Paleozoic, Mesozoic and Coenozoic • Each era divided into periods (names of periods not to be memorised) • Major events (extinctions/appearances of life forms) in each era of the geological time scale

Evidence for evolution	❑ Outline the contribution of each of the following in providing evidence for evolution: • Paleontology: o State what a fossil is. o State the role of fossils in understanding ancient life. o Explain how fossils are formed. o Explain how interpretation of fossil records helps to develop patterns of development amongst species through the observation of homologous and analogous structures. o Radiometric dating as a method of finding out the age of fossils using radioactive chemicals. o List the uses of fossils in what the fossil records tell us about: • The age of the earth • When life forms first developed • The complexity of life forms today compared to those that existed in the past • The appearance of today's life forms compared to those that existed in the past • Comparative embryology o Comparison of the embryos of different vertebrates to show similarities • Comparative anatomy o Comparison of homologous and analogous structures among organisms to show similarities and differences eg. homologous bone structures in the front limbs of different vertebrates, **vestigial structures**. • Comparative biochemistry o List the following features that show possible common origin of different organisms: • Identical DNA structure • Similar sequence of genes • Similar portions of DNA with no function • Identical protein synthesis • Similar metabolic pathways such as glycolysis, Krebs cycle and electron transport system • Biogeography o State that different but closely related species in similar biomes across the world have similar features in adapting to that biome, indicating that they probably developed from a common ancestral species.

Mass Extinctions	❑ State what is meant by mass extinction. ❑ State that mass extinctions are periods in the earth's history when biodiversity crashed. ❑ Describe the contribution of the following factors to the five major mass extinctions: • Earthly Theories of Mass Extinctions (related to factors concerning the earth) o Ice Ages o Continental drift o Plate Tectonics o Volcanic activity o Disease • Extraterrestrial theories (due to factors outside of the planet earth) o "Something large" from outer space struck the Earth. This "something large" may have been a comet, an asteroid or part of a star o Results of this something large striking earth: large clouds of dust blocking out sun and stopping photosynthesis, global cooling, world-wide fires, monstrous tsunamis, extinction of many forms of life

Human origins

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Our place in the animal kingdom	❑ Interpret a phylogenetic tree to show the place of the family Hominidae in the animal kingdom.
Characteristics we share with other primates	❑ List the following as characteristics that we share with other primates: • Opposable thumb **(monkeys capable of power grip only – humans capable of power and precision grip)** • Bare finger tips • Long arms • Freely rotating arms • Stereoscopic vision • Eyes with cones (in addition to rods) • Large brain compared to body mass • Portions of brain centres that process information from hands and eyes enlarged • Olfactory brain centres diminished • Few offspring
Characteristics that make us different from other primates	❑ List the following as characteristics that make us different from other primates: • Bipedalism (always bipedal) • Flat face (no prognathous) • Dentition similar to that of monkeys and apes but different from that of older primates • Smaller canines • Jaws in which all teeth are on a gentle curve • Large brain (1 200 to 1 800 mℓ; average 1 400 mℓ) • Artificial language • Opposable thumb **(capable of power and precision grip)**

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Trends in human evolution	❑ List the following changes in structure that characterise human evolution: • Shift of foramen magnum to a more forward position • A more rounded skull and increased cranium size • A flatter face due to: o Less sloping forehead o Less protruding jaws (decreased prognathous) o A more developed chin o A more rounded jaw o Increased size of skeleton o Change in dentition
	❑ With reference to the organisms listed below trace the 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) • *Homo habilis* (Handyman) • *Homo erectus* • *Homo sapiens* (modern humans, Florisbad man)
Search for the cradle of humankind	❑ Explain what is meant by anthropology, palaeontology and archaeology. ❑ State that the search for the cradle of humankind has moved from South Africa to East Africa to Central Africa in the light of fossil evidence. ❑ List reasons for population movements. ❑ Briefly outline the contributions of South African scientists in unearthing fossil evidence.

Alternatives to the evolutionary theory of diversity

CONTENT	ELABORATION/SUGGESTED SEQUENCE
Arguments against evolution	❑ Age of the earth ❑ The probability of forming organic molecules by chance ❑ The tendency towards disorderliness ❑ Gaps in the fossil record