



# **basic education**

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Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## **LIFE SCIENCES**

### **EXAMINATION GUIDELINES**

### **SENIOR CERTIFICATE (SC)**

**GRADE 12**

**2015**

**These guidelines consist of 19 pages.**

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## 1. INTRODUCTION

The Curriculum and Assessment Policy Statement (CAPS) for Life Sciences outlines the nature and purpose of the subject Life Sciences. This guides the philosophy underlying the teaching and assessment of the subject in Grade 12.

The purpose of these Examination Guidelines is to provide clarity on the depth and scope of the content to be assessed in the Grade 12 Senior Certificate (SC) Examination in Life Sciences.

These Examination Guidelines should be read in conjunction with:

- A résumé of subjects for the Senior Certificate
- Curriculum and Assessment Policy Statements for all approved subjects:

## 2. ASSESSMENT IN GRADE 12

### 2.1 FORMAT OF THE QUESTION PAPER

The examination will consist of two question papers of 2½ hours and 150 marks each. Each question paper will have the following format:

SECTION	TYPES OF QUESTIONS	MARKS
A	Short answers, objective questions such as multiple-choice questions, terminology, matching items	50
B	A variety of questions types: 2 questions of 40 marks each, divided into 3 to 4 subsections	2 x 40 = 80
C	A mini-essay	20

### 2.2. TOPICS AND WEIGHTINGS OF TOPICS

The tables below show the topics that constitute each of the two papers in the Life Sciences as well as the weighting of each topic in the relevant paper.

PAPER 1		
Topic	Weighting	
	%	Marks
Meiosis	7	11
Reproduction in Vertebrates	4	6
Human Reproduction	21	31
Responding to the Environment (Humans)	27	40
Human Endocrine System	10	15
Homeostasis in Humans	7	11
Responding to the Environment (Plants)	7	11
Human Impact (from Grade 11)	17	25
	<b>100</b>	<b>150</b>
PAPER 2		
Topic	Weighting	
	%	Marks
DNA: Code of Life	19	27
Meiosis	7	12
Genetics and Inheritance	30	45
Evolution	44	66
	<b>100</b>	<b>150</b>

### 3. ELABORATION OF CONTENT FOR GRADE 12 (CAPS) FROM 2014

A topic-wise elaboration follows, indicating the scope and depth of each topic. Note that the content elaborated does not attempt to address all four cognitive levels. It merely outlines the basic content that needs to be covered, but this content can be assessed at all four cognitive levels.

DNA: The Code of Life Paper 2: 27 marks	Term 1	2½ weeks
CONTENT	ELABORATION	
<b>Introduction</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Revise the structure of the cell with an emphasis on the ribosome, cytoplasm and the parts of the nucleus.</li> <li><input type="checkbox"/> State that nucleic acids consist of nucleotides.</li> <li><input type="checkbox"/> Name the two types of nucleic acids.</li> </ul>	
<b>DNA: location, structure and functions</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> State where DNA is located, as follows:               <ul style="list-style-type: none"> <li>• Makes up the genes on chromosomes (nuclear DNA)</li> <li>• Present in mitochondria (mitochondrial DNA)</li> </ul> </li> <li><input type="checkbox"/> Describe the history of the discovery of the DNA molecule (Watson, Crick, Franklin &amp; Wilkins).</li> <li><input type="checkbox"/> Name the three components of a DNA nucleotide as follows:               <ul style="list-style-type: none"> <li>• Nitrogenous bases linked by weak hydrogen bonds                   <ul style="list-style-type: none"> <li>- Four nitrogenous bases of DNA: adenine (A), thymine (T), cytosine (C), guanine (G)</li> <li>- Pairing of bases in DNA occurs as follows: A : T and G : C</li> </ul> </li> <li>• Sugar portion (deoxyribose in DNA)</li> <li>• Phosphate portion</li> </ul> </li> <li><input type="checkbox"/> State that the natural shape of the DNA molecule is a double helix.</li> <li><input type="checkbox"/> State the functions of DNA in terms of the following:               <ul style="list-style-type: none"> <li>• Sections of DNA forming genes carry hereditary information</li> <li>• DNA contains coded information for protein synthesis</li> </ul> </li> </ul>	
<b>DNA replication</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Describe the following aspects of DNA replication:               <ul style="list-style-type: none"> <li>• When it takes place in the cell cycle</li> <li>• Where it takes place in the cell</li> <li>• How DNA replication takes place (names of enzymes not required)</li> <li>• The significance of DNA replication</li> </ul> </li> </ul>	
<b>DNA profiling</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> State what a <i>DNA profile/DNA 'fingerprint'</i> is.</li> <li><input type="checkbox"/> State the various uses of DNA profiles.</li> <li><input type="checkbox"/> State views for and against DNA profiling.</li> </ul>	
<b>RNA: location, structure and function</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> State the location of RNA as follows:               <ul style="list-style-type: none"> <li>• mRNA is formed in the nucleus and functions on the ribosome.</li> <li>• tRNA is located in the cytoplasm.</li> </ul> </li> <li><input type="checkbox"/> State that RNA plays a role in protein synthesis.</li> <li><input type="checkbox"/> Describe the structure of RNA as follows:               <ul style="list-style-type: none"> <li>• A single-stranded molecule consisting of nucleotides</li> <li>• Each nucleotide is made up of a sugar (ribose), phosphate and a nitrogen base</li> <li>• Four nitrogenous bases of RNA: adenine (A), uracil (U), cytosine (C), guanine (G)</li> </ul> </li> </ul>	
<b>Comparison of DNA and RNA</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> List similarities between DNA and RNA.</li> <li><input type="checkbox"/> Tabulate differences between DNA and RNA.</li> </ul>	

CONTENT	ELABORATION
<b>Protein synthesis</b>	<ul style="list-style-type: none"> <li>❑ Define <i>protein synthesis</i>.</li> <li>❑ Describe the involvement of DNA and RNA in protein synthesis as follows: <ul style="list-style-type: none"> <li>• Transcription <ul style="list-style-type: none"> <li>• Double-stranded DNA unzips</li> <li>• when the hydrogen bonds break.</li> <li>• One strand is used as a template</li> <li>• to form mRNA</li> <li>• using free RNA nucleotides from the nucleoplasm.</li> <li>• The mRNA is complementary to the DNA.</li> <li>• mRNA now has the coded message for protein synthesis.</li> </ul> </li> <li>• mRNA moves from the nucleus to the cytoplasm and attaches to the ribosome.</li> <li>• Translation <ul style="list-style-type: none"> <li>• Each tRNA carries a specific amino acid.</li> <li>• When the anticodon on the tRNA</li> <li>• matches the codon on the mRNA</li> <li>• then tRNA brings the required amino acid to the ribosome. (Names of specific codons, anticodons and their amino acids are not to be memorised.)</li> <li>• Amino acids become attached by peptide bonds</li> <li>• to form the required protein.</li> </ul> </li> </ul> </li> </ul>

<b>Meiosis</b> Paper 1: 11 marks & Paper 2: 12 marks	<b>Term 1</b>	<b>2 weeks</b>
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CONTENT	ELABORATION
<b>Introduction</b>	<ul style="list-style-type: none"> <li>❑ Review the structure of a cell with an emphasis on the parts of the nucleus, the centrosome and the cytoplasm</li> <li>❑ State that: <ul style="list-style-type: none"> <li>• Chromosomes consists of DNA (which makes up genes) and protein</li> <li>• The number of chromosomes in a cell is a characteristic of an organism (e.g. humans have 46 chromosomes)</li> <li>• Chromosomes which are single stranded become double stranded (two chromatids joined by a centromere) as a result of DNA replication</li> </ul> </li> <li>❑ Differentiate between: <ul style="list-style-type: none"> <li>• Haploid (n) and diploid (2n) cells in terms of chromosome number</li> <li>• Sex cells (gametes) and somatic cells (body cells)</li> <li>• Sex chromosomes (gonosomes) and autosomes</li> </ul> </li> <li>❑ Review the process of mitosis.</li> </ul>

CONTENT	ELABORATION
<b>Meiosis – The process</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Define <i>meiosis</i>.</li> <li><input type="checkbox"/> State where meiosis takes place in plants and in animals.</li> <li><input type="checkbox"/> State that interphase takes place before meiosis and that although meiosis is a continuous process, the events are divided into different phases for convenience.</li> <li><input type="checkbox"/> Describe what happens during interphase as follows: <ul style="list-style-type: none"> <li>• DNA replication takes place</li> <li>• Single-stranded chromosomes become double stranded</li> <li>• Each chromosome will now consist of two chromatids joined by a centromere</li> <li>• DNA replication helps to double the genetic material so that it can be shared by the new cells arising from cell division</li> </ul> </li> <li><input type="checkbox"/> Describe the events of the following phases of Meiosis I: <ul style="list-style-type: none"> <li>• Prophase I <ul style="list-style-type: none"> <li>- Also include a description of crossing over</li> </ul> </li> <li>• Metaphase I</li> <li>• Anaphase I</li> <li>• Telophase I</li> </ul> </li> <li><input type="checkbox"/> Describe the events of each phase of Meiosis II as follows: <ul style="list-style-type: none"> <li>• Prophase II</li> <li>• Metaphase II</li> <li>• Anaphase II</li> <li>• Telophase II</li> </ul> </li> </ul>
<b>Importance of meiosis</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> State the importance of meiosis with regard to each of the following: <ul style="list-style-type: none"> <li>• Production of gametes</li> <li>• Halving of the chromosome number (diploid to haploid)</li> <li>• Mechanism to introduce genetic variation through: <ul style="list-style-type: none"> <li>• Crossing over</li> <li>• The random arrangement of chromosomes at the equator</li> </ul> </li> </ul> </li> </ul>
<b>Abnormal meiosis</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> State what is meant by <i>non-disjunction</i>.</li> <li><input type="checkbox"/> State the consequences of non-disjunction.</li> <li><input type="checkbox"/> Describe how non-disjunction of chromosome pair 21 in humans leads to the formation of an abnormal gamete with an extra copy of chromosome 21.</li> <li><input type="checkbox"/> Describe how the fusion between the abnormal gamete and a normal gamete may lead to Down syndrome.</li> </ul>
<b>Comparison of mitosis and meiosis</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> List similarities in mitosis and meiosis.</li> <li><input type="checkbox"/> Tabulate differences between mitosis and meiosis.</li> </ul>

<b>Reproduction in vertebrates</b> Paper 1: 6 marks	<b>Term 1</b>	<b>½ week</b>
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CONTENT	ELABORATION
<b>Diversity of reproductive strategies</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Describe the role of the following reproductive strategies in animals in maximising reproductive success in different environments (using relevant examples): <ul style="list-style-type: none"> <li>• External fertilisation and internal fertilisation</li> <li>• Ovipary, ovovivipary and vivipary</li> <li>• Amniotic egg</li> <li>• Precocial and altricial development</li> <li>• Parental care</li> </ul> </li> </ul>

<b>Human reproduction</b> Paper 1: 31 marks		<b>Term 1</b>	<b>3 weeks</b>
<b>CONTENT</b>	<b>ELABORATION</b>		
<b>Introduction</b>	<input type="checkbox"/> Review the schematic outline of the human life cycle to show the role of meiosis, mitosis and fertilisation.		
<b>Structure of the male reproductive system</b>	<input type="checkbox"/> Identify and state the functions of the testis, epididymis, vas deferens, seminal vesicle, ejaculatory duct, prostate gland, Cowper's gland and the urethra.		
<b>Structure of the female reproductive system</b>	<input type="checkbox"/> Identify and state the functions of the ovary, Fallopian tubes, uterus with uterine wall lined by endometrium, cervix, vagina and its external opening and the vulva. <input type="checkbox"/> In a section through the ovary, identify and state the functions of: follicles at various stages of development; the Graafian follicle and the corpus luteum.		
<b>Puberty</b>	<input type="checkbox"/> List the main changes that occur in male characteristics during puberty under the influence of testosterone. <input type="checkbox"/> List the main changes that occur in female characteristics during puberty under the influence of oestrogen.		
<b>Gametogenesis</b>	<input type="checkbox"/> Define each of the following terms: <ul style="list-style-type: none"> <li>• Gametogenesis</li> <li>• Spermatogenesis</li> <li>• Oogenesis</li> </ul> <input type="checkbox"/> Describe spermatogenesis as follows: <ul style="list-style-type: none"> <li>• Diploid cells in the seminiferous tubules of the testes undergo meiosis</li> <li>• to form haploid sperm cells.</li> </ul> <input type="checkbox"/> Identify and state the functions of the parts of a sperm cell (acrosome, head with haploid nucleus, middle portion/neck with mitochondria and a tail). <input type="checkbox"/> Describe oogenesis as follows: <ul style="list-style-type: none"> <li>• Diploid cells in the ovary undergo meiosis</li> <li>• to form a primary follicle consisting of haploid cells.</li> <li>• One cell develops into an ovum contained in a Graafian follicle.</li> </ul> <input type="checkbox"/> Identify and state the functions of the different parts of an ovum (layer of jelly, haploid nucleus, cytoplasm).		
<b>Menstrual cycle</b>	<input type="checkbox"/> State that the menstrual cycle includes the uterine and ovarian cycles. <input type="checkbox"/> Describe the following events in the ovarian cycle: <ul style="list-style-type: none"> <li>• Development of the Graafian follicle</li> <li>• Ovulation</li> <li>• Formation of the corpus luteum</li> </ul> <input type="checkbox"/> Describe the following events in the uterine cycle: <ul style="list-style-type: none"> <li>• Changes that take place in the thickness of the endometrium</li> <li>• Menstruation</li> </ul> <input type="checkbox"/> Describe the hormonal control of the menstrual cycle (ovarian and uterine cycles) with reference to the action of FSH, oestrogen, LH and progesterone. <input type="checkbox"/> Describe the negative-feedback mechanism involving FSH and progesterone in controlling the production of ova.		



## Examination Guidelines – Senior Certificate

CONTENT	ELABORATION
<b>Fertilisation and development of zygote to blastocyst</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Define <i>copulation</i> and <i>fertilisation</i>.</li> <li><input type="checkbox"/> State where, and describe how, fertilisation occurs.</li> <li><input type="checkbox"/> Describe the following development: zygote → morula → blastocyst → embryo.</li> </ul>
<b>Gestation</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Define <i>implantation</i>.</li> <li><input type="checkbox"/> State the role of oestrogen and progesterone in maintaining pregnancy.</li> <li><input type="checkbox"/> Identify and state the functions of the following parts of the developing embryo/foetus: <ul style="list-style-type: none"> <li>• Chorion and chorionic villi</li> <li>• Amnion, amniotic cavity and amniotic fluid</li> <li>• Umbilical cord (including umbilical artery and umbilical vein)</li> <li>• Placenta</li> </ul> </li> </ul>
<b>Birth</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Name the three stages of the natural birth process (labour, expulsion of baby, release of the afterbirth).</li> </ul>

<b>Genetics and inheritance</b> Paper 2: 45 marks	<b>Term 2</b>	<b>4 weeks</b>
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CONTENT	ELABORATION
<b>Introduction</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Define each of the following: <ul style="list-style-type: none"> <li>• Genetics</li> <li>• Inheritance</li> <li>• Variation</li> </ul> </li> <li><input type="checkbox"/> Outline the experiments conducted by Mendel.</li> </ul>
<b>Concepts in inheritance</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Differentiate between each of the following: <ul style="list-style-type: none"> <li>• Chromatin and chromosomes</li> <li>• Genes and alleles</li> <li>• Phenotype and genotype</li> <li>• Dominant and recessive alleles <ul style="list-style-type: none"> <li>- State Mendel's Law of Dominance</li> </ul> </li> <li>• Homozygous (pure breeding) and heterozygous (hybrid)</li> <li>• Monohybrid cross and dihybrid cross</li> </ul> </li> </ul>
<b>Monohybrid crosses</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Write down the format for representing a genetics cross.</li> <li><input type="checkbox"/> State Mendel's principle of segregation.</li> <li><input type="checkbox"/> Solve monohybrid genetics problems.</li> <li><input type="checkbox"/> Determine proportion and ratio of genotypes and phenotypes.</li> </ul>
<b>Types of dominance</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Use examples to distinguish amongst the following: <ul style="list-style-type: none"> <li>• <b>Complete dominance</b> – one allele is dominant over the other; the other is recessive</li> <li>• <b>Incomplete dominance</b> – none of the two alleles of a gene is dominant</li> <li>• <b>Co-dominance</b> – both alleles of a gene are equally dominant</li> </ul> </li> <li><input type="checkbox"/> Solve genetics problems involving each of the three types of dominance.</li> </ul>

CONTENT	ELABORATION
<b>Sex determination</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Differentiate between <i>sex chromosomes (gonosomes)</i> and <i>autosomes</i> in the karyotypes of human males and females.</li> <li><input type="checkbox"/> Represent a genetic cross to show the inheritance of sex.</li> </ul>
<b>Blood grouping</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> State what is meant by <i>multiple alleles</i>.</li> <li><input type="checkbox"/> Using the alleles <math>I^A</math>, <math>I^B</math> and <math>i</math>, show how the four blood groups arise.</li> <li><input type="checkbox"/> Solve genetics problems involving the inheritance of blood type.</li> </ul>
<b>Mutations</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> State what is meant by a <i>mutation</i>.</li> <li><input type="checkbox"/> State the causes of mutations.</li> <li><input type="checkbox"/> Differentiate between <i>harmful mutations</i>, <i>harmless mutations</i> and <i>useful mutations</i>.</li> <li><input type="checkbox"/> Differentiate between a <i>gene mutation</i> and a <i>chromosomal aberration</i>.</li> <li><input type="checkbox"/> Describe how mutations contribute to genetic variation and natural selection.</li> <li><input type="checkbox"/> Describe how mutations lead to altered characteristics in each of the following genetic disorders: <ul style="list-style-type: none"> <li>• Haemophilia – absence of blood-clotting factors</li> <li>• Colour-blindness – absence of the proteins that comprise either the red or green cones/photoreceptors in the eye</li> <li>• Albinism – absence of pigmentation</li> </ul> </li> </ul>
<b>Sex-linked inheritance</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Differentiate between <i>sex chromosomes (gonosomes)</i> and <i>autosomes</i>.</li> <li><input type="checkbox"/> State what is meant by <i>sex-linked characteristics</i>.</li> <li><input type="checkbox"/> Solve genetics problems involving the following sex-linked characteristics: <ul style="list-style-type: none"> <li>• Haemophilia</li> <li>• Colour-blindness</li> </ul> </li> </ul>
<b>Genetic lineages/ pedigrees</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> State what is meant by a <i>genetic pedigree</i>.</li> <li><input type="checkbox"/> Interpret pedigree diagrams showing the inheritance of characteristics over many generations.</li> </ul>
<b>Genetic engineering</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> State what is meant by <i>genetic engineering</i>.</li> <li><input type="checkbox"/> State what is meant by <i>biotechnology</i>.</li> <li><input type="checkbox"/> Describe how each of the following examples of genetic engineering represent the use of biotechnology to satisfy human needs: <ul style="list-style-type: none"> <li>• Stem cell research (what are stem cells; sources of stem cells; uses of stem cells)</li> <li>• Genetic modification (example in plants and animals; benefits of genetic modification)</li> <li>• Cloning (an example; description of process)</li> </ul> </li> <li><input type="checkbox"/> State views for and against genetic engineering.</li> </ul>
<b>Paternity testing</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Describe the role of each of the following in paternity testing: <ul style="list-style-type: none"> <li>• Blood grouping</li> <li>• DNA profiles</li> </ul> </li> </ul>
<b>Genetic links</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Describe how mutations in mitochondrial DNA may be used in tracing female ancestry.</li> </ul>
<b>Dihybrid crosses</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> State Mendel's principle of independent assortment.</li> <li><input type="checkbox"/> Solve dihybrid genetics problems.</li> <li><input type="checkbox"/> Determine proportion/ratio of genotypes and phenotypes.</li> </ul>

<b>Responding to the environment – humans</b> Paper 1: 40 marks	<b>Term 2</b>	<b>4 weeks</b>
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<b>CONTENT</b>	<b>ELABORATION</b>
<b>Introduction</b>	<ul style="list-style-type: none"> <li>❑ Differentiate between the <i>nervous system</i> (involving nerves) and the <i>endocrine system</i> (involving hormones) as two components that help us respond to the environment.</li> </ul>
<b>Human nervous system</b>	<ul style="list-style-type: none"> <li>❑ Explain the need for a nervous system in humans in terms of: <ul style="list-style-type: none"> <li>• Reaction to stimuli (stimuli can be external and internal)</li> <li>• Coordination of the various activities of the body</li> </ul> </li> </ul>
<b>Central nervous system</b>	<ul style="list-style-type: none"> <li>❑ State that the brain and spinal cord are protected by meninges.</li> <li>❑ State the location and provide the functions of the following parts: <ul style="list-style-type: none"> <li>• Cerebrum</li> <li>• Cerebellum</li> <li>• Corpus callosum</li> <li>• Medulla oblongata</li> <li>• Spinal cord</li> </ul> </li> </ul>
<b>Peripheral nervous system</b>	<ul style="list-style-type: none"> <li>❑ State the location and provide the functions of the peripheral nervous system (cranial and spinal nerves).</li> </ul>
<b>Autonomic nervous system</b>	<ul style="list-style-type: none"> <li>❑ State the location and provide the functions of the autonomic nervous system (sympathetic and parasympathetic sections).</li> </ul>
<b>Structure and functioning of a nerve</b>	<ul style="list-style-type: none"> <li>❑ Identify and state the functions of each of the following parts of sensory and motor neurons: nucleus, cell body, cytoplasm, myelin sheath, axon and dendrites.</li> </ul>
<b>The simple reflex arc</b>	<ul style="list-style-type: none"> <li>❑ Differentiate between a <i>reflex action</i> and a <i>reflex arc</i>.</li> <li>❑ Identify and state the function of each of the following components of a simple reflex arc: receptor, sensory neuron, dorsal root of spinal nerve, spinal cord, interneuron, motor neuron, ventral root of spinal nerve, effector.</li> <li>❑ Describe the functioning of a simple reflex action, using an example.</li> <li>❑ State the significance of a reflex action.</li> <li>❑ State the significance of synapses.</li> </ul>
<b>Disorders of the CNS</b>	<ul style="list-style-type: none"> <li>❑ State the causes and symptoms of the following disorders of the nervous system: <ul style="list-style-type: none"> <li>• Alzheimer's disease</li> <li>• Multiple sclerosis</li> </ul> </li> </ul>
<b>Injuries</b>	<ul style="list-style-type: none"> <li>❑ Describe the consequences of possible brain and spinal injuries and state the use of stem cell research in the possible repairing of injuries.</li> </ul>
<b>Effects of drugs</b>	<ul style="list-style-type: none"> <li>❑ List the negative effects of drugs on the central nervous system.</li> </ul>

CONTENT	ELABORATION
<b>Receptors</b>	<ul style="list-style-type: none"> <li>❑ State how receptors, neurons and effectors function together in responding to the environment.</li> <li>❑ State that the body responds to a variety of different stimuli, such as light, sound, touch, temperature, pressure, pain and chemicals (taste and smell). (No structure and names are necessary, except for the names of the receptors in the eye and ear.)</li> </ul>
<b>Human eye</b>	<ul style="list-style-type: none"> <li>❑ Describe the structure and state the functions of the parts of the human eye.</li> <li>❑ State what is meant by <i>binocular vision</i>.</li> <li>❑ Describe the changes that occur in the human eye for each of the following: <ul style="list-style-type: none"> <li>• Accommodation</li> <li>• Pupil reflex/pupillary mechanism</li> </ul> </li> <li>❑ Describe each of the following visual defects using diagrams, and state how each visual defect is treated: <ul style="list-style-type: none"> <li>• Short-sightedness</li> <li>• Long-sightedness</li> <li>• Astigmatism</li> <li>• Cataracts</li> </ul> </li> </ul>
<b>Human ear</b>	<ul style="list-style-type: none"> <li>❑ Describe the structure and state the functions of the different parts of the human ear.</li> <li>❑ Describe the functioning of the human ear in: <ul style="list-style-type: none"> <li>• Hearing (include the role of the organ of Corti, without details of its structure)</li> <li>• Balance (include the role of maculae and cristae, without details of their structure)</li> </ul> </li> <li>❑ Describe the cause and state the treatment of the following hearing defects: <ul style="list-style-type: none"> <li>• Middle ear infection (treatment using grommets)</li> <li>• Deafness (treatment using hearing aids and cochlear implants)</li> </ul> </li> </ul>

<b>Human endocrine system</b> Paper 1: 15 marks		<b>Term 3</b>	<b>1½ weeks</b>
CONTENT	ELABORATION		
<b>Introduction</b>	<ul style="list-style-type: none"> <li>❑ Differentiate between <i>endocrine glands</i> and <i>exocrine glands</i>.</li> <li>❑ Define a <i>hormone</i>.</li> <li>❑ State the location of each of the following glands, the hormones they secrete and function(s) of each hormone: <ul style="list-style-type: none"> <li>• Hypothalamus (ADH)</li> <li>• Pituitary/Hypophysis (GH, TSH, FSH, LH, prolactin)</li> <li>• Thyroid gland (thyroxin)</li> <li>• Pancreas/Islets of Langerhans (insulin, glucagon)</li> <li>• Adrenal glands (adrenalin, aldosterone)</li> <li>• Ovary (oestrogen, progesterone)</li> <li>• Testis (testosterone)</li> </ul> </li> <li>❑ State what is meant by <i>negative feedback</i>.</li> <li>❑ Describe the negative feedback mechanism involving: <ul style="list-style-type: none"> <li>• TSH and thyroxin (and the result of an imbalance: thyroid disorders)</li> <li>• Insulin and glucagon (and the result of an imbalance: diabetes mellitus)</li> </ul> </li> </ul>		

<b>Homeostasis in humans</b> Paper 1: 11 marks	<b>Term 3</b>	<b>1 week</b>
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CONTENT	ELABORATION
<b>Introduction</b>	<ul style="list-style-type: none"> <li>❑ Define <i>homeostasis</i> as the process of maintaining a constant, internal environment within narrow limits, despite changes that take place internally and externally.</li> <li>❑ State that the conditions within cells depend on the conditions within the internal environment (tissue fluid).</li> <li>❑ List the factors/conditions within the tissue fluid that should be kept constant, within narrow limits.</li> </ul>
<b>Homeostasis through negative feedback</b>	<ul style="list-style-type: none"> <li>❑ Describe the control of the levels of the following through negative feedback: <ul style="list-style-type: none"> <li>• Glucose</li> <li>• Carbon dioxide</li> <li>• Water</li> <li>• Salts</li> </ul> </li> </ul>
<b>Temperature regulation</b>	<ul style="list-style-type: none"> <li>❑ Identify the different parts of the skin involved in thermoregulation.</li> <li>❑ Describe the role of each of the following in thermoregulation: <ul style="list-style-type: none"> <li>• Sweating</li> <li>• Vasodilation</li> <li>• Vasoconstriction</li> </ul> </li> </ul>

<b>Responding to the environment – plants</b> Paper 1: 11 marks	<b>Term 3</b>	<b>1 week</b>
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CONTENT	ELABORATION
<b>Plant hormones</b>	<ul style="list-style-type: none"> <li>❑ List the functions of the following: <ul style="list-style-type: none"> <li>• Auxins</li> <li>• Gibberellins</li> <li>• Abscisic acid</li> </ul> </li> <li>❑ Describe the control of weeds using plant hormones.</li> <li>❑ Describe the role of auxins in: <ul style="list-style-type: none"> <li>• Geotropism</li> <li>• Phototropism</li> </ul> </li> </ul>
<b>Plant defence mechanisms</b>	<ul style="list-style-type: none"> <li>❑ State how each of the following is used by plants as defence: <ul style="list-style-type: none"> <li>• Chemicals</li> <li>• Thorns</li> </ul> </li> </ul>

<b>Evolution</b> Paper 2: 66 marks	<b>Terms 3/4</b>	<b>6 weeks</b>
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<b>CONTENT</b>	<b>ELABORATION</b>
<b>Introduction</b>	<ul style="list-style-type: none"> <li>❑ Define <i>evolution</i> and <i>biological evolution</i>.</li> <li>❑ State the difference between a <i>hypothesis</i> and a <i>theory</i>.</li> <li>❑ State that the Theory of Evolution is regarded as a scientific theory since various hypotheses relating to evolution have been tested and verified over time.</li> </ul>
<b>Evidence for evolution</b>	<ul style="list-style-type: none"> <li>❑ Describe how each of the following provides evidence for evolution: <ul style="list-style-type: none"> <li>• Fossil record</li> <li>• Modification by descent (homologous structures)</li> <li>• Biogeography</li> <li>• Genetics</li> </ul> </li> </ul>
<b>Variation</b>	<ul style="list-style-type: none"> <li>❑ Define a <i>species</i> and a <i>population</i>.</li> <li>❑ Describe how each of the following contributes to variation amongst individuals of the same species: <ul style="list-style-type: none"> <li>• Meiosis <ul style="list-style-type: none"> <li>- Crossing over</li> <li>- Random arrangement of chromosomes</li> </ul> </li> <li>• Mutations</li> <li>• Chance fertilisation</li> <li>• Random mating</li> </ul> </li> <li>❑ Differentiate between <i>continuous variation</i> and <i>discontinuous variation</i>.</li> </ul>
<b>Origin of the idea about origins (a historical development)</b>	<ul style="list-style-type: none"> <li>❑ Draw a timeline of the development and the contribution of different scientists towards our understanding of evolution, including the following: <ul style="list-style-type: none"> <li>• Lamarckism</li> <li>• Darwinism</li> <li>• Punctuated equilibrium</li> </ul> </li> </ul>
<b>Lamarckism (Jean Baptiste de Lamarck – 1744–1829)</b>	<ul style="list-style-type: none"> <li>❑ Describe what is meant by each of the following 'Laws' used by Lamarck to explain evolution: <ul style="list-style-type: none"> <li>• 'Law' of use and disuse</li> <li>• 'Law' of the inheritance of acquired characteristics</li> </ul> </li> <li>❑ Give reasons for Lamarck's theory being rejected.</li> </ul>

CONTENT	ELABORATION
<p><b>Darwinism (Charles Darwin – 1809–1882)</b></p>	<ul style="list-style-type: none"> <li>❑ State the observations upon which Darwin based his theory:               <ul style="list-style-type: none"> <li>• Organisms of a species produce a large number of offspring</li> <li>• The offspring show a great deal of variation</li> <li>• Of the large number of offspring produced, only a few survive</li> <li>• Characteristics are inherited from surviving parents to offspring</li> </ul> </li>   <li>❑ Describe Darwin's theory of evolution by natural selection as follows:               <ul style="list-style-type: none"> <li>• Organisms produce a large number of offspring.</li> <li>• There is a great deal of variation amongst the offspring.</li> <li>• Some have favourable characteristics and some do not.</li> <li>• When there is a change in the environmental conditions or if there is competition,</li> <li>• then organisms with characteristics which make them more suited, survive,</li> <li>• whilst organisms with characteristics that make them less suited, die.</li> <li>• The organisms that survive, reproduce</li> <li>• and thus pass on the favourable characteristic to their offspring.</li> <li>• The next generation will therefore have a higher proportion of individuals with the favourable characteristic.</li> </ul> </li> </ul>
<p><b>Artificial selection</b></p>	<ul style="list-style-type: none"> <li>❑ State what is meant by <i>artificial selection</i>.</li> <li>❑ Describe <i>artificial selection</i> using an example of each of the following:               <ul style="list-style-type: none"> <li>• A domesticated animal species</li> <li>• A crop species</li> </ul> </li>   <li>❑ List similarities between <i>natural selection</i> and <i>artificial selection</i>.</li> <li>❑ Tabulate differences between <i>natural selection</i> and <i>artificial selection</i>.</li> </ul>
<p><b>Punctuated equilibrium</b></p>	<p>Based on Darwinism, it is thought that evolution takes place through an accumulation of small or gradual changes that occur over a long period of time. This is supported by the many transitional fossils in the fossil record which show the progressive changes over time.</p> <ul style="list-style-type: none"> <li>❑ Describe how punctuated equilibrium explains the speed at which evolution takes place, as follows:               <ul style="list-style-type: none"> <li>• According to punctuated equilibrium, evolution is not gradual as proposed by Darwinism.</li> <li>• Evolution involves long periods of time where species do not change or change very little (known as equilibrium).</li> <li>• This alternates with (is punctuated by) short periods of time where rapid changes occur through natural selection.</li> <li>• As a result new species are formed in a short period of time, relative to the long periods of no/little change.</li> <li>• This is supported by the absence of transitional fossils (usually termed missing links) indicating the period of rapid change.</li> </ul> </li> </ul>

CONTENT	ELABORATION
<p><b>Formation of new species</b></p>	<ul style="list-style-type: none"> <li>❑ Define a <i>species</i> and a <i>population</i>.</li> <li>❑ Differentiate between <i>speciation</i> and <i>extinction</i> and state the effect of each on biodiversity.</li> <li>❑ Give a general account on speciation through geographic isolation as follows: <ul style="list-style-type: none"> <li>• If a population of a single species</li> <li>• becomes separated by a geographical barrier (sea, river, mountain, lake),</li> <li>• then the population splits into two populations.</li> <li>• There is now no gene flow between the two populations.</li> <li>• Since each population may be exposed to different environmental conditions,</li> <li>• natural selection occurs independently in each of the two populations</li> <li>• such that the individuals of the two populations become very different from each other</li> <li>• genotypically and phenotypically.</li> <li>• Even if the two populations were to mix again,</li> <li>• they will not be able to reproduce with each other.</li> <li>• They have thus become different species.</li> </ul> </li> <li>❑ Describe speciation through geographic isolation using any ONE of the following examples: <ul style="list-style-type: none"> <li>• Galapagos finches</li> <li>• Galapagos tortoises</li> <li>• Plants on different land masses (linked to continental drift) <ul style="list-style-type: none"> <li>- Baobabs in Africa and Madagascar</li> <li>- Proteas in South Africa and Australia</li> </ul> </li> <li>• Any example of mammals on different land masses</li> </ul> </li> </ul>
<p><b>Keeping species separate (Mechanisms of reproductive isolation)</b></p>	<ul style="list-style-type: none"> <li>❑ When one species gives rise to two new species (speciation), the two species cannot reproduce with each other even if they mix. They remain as separate species due to mechanisms that restrict gene flow between them.</li> </ul> <p>Describe how each of the following reproductive isolation mechanisms help in keeping species separate:</p> <ul style="list-style-type: none"> <li>• Breeding at different times of the year</li> <li>• Species-specific courtship behaviour (animals)</li> <li>• Adaptation to different pollinators (plants)</li> <li>• Infertile offspring (e.g. mules)</li> </ul>
<p><b>Evolution in present times</b></p>	<ul style="list-style-type: none"> <li>❑ Explain that natural selection and evolution are still occurring in present times by using any ONE of the following examples: <ul style="list-style-type: none"> <li>• The use of DDT and the consequent resistance to DDT in insects which can be explained in terms of natural selection</li> <li>• Bill (Beak) and body size of Galapagos finches</li> <li>• The development of resistant strains of tuberculosis-causing bacteria (MDR and XDR) to antibiotics due to mutations (variations) in bacteria and failure to complete antibiotic courses</li> <li>• HIV resistance to anti-retroviral medication</li> </ul> </li> </ul>



CONTENT	ELABORATION
<p><b>Evidence of common ancestors for living hominids, including humans</b></p>	<ul style="list-style-type: none"> <li>❑ Interpret a phylogenetic tree to show the place of the family <i>Hominidae</i> in the animal kingdom.</li> <li>❑ Describe the following evidence that supports the idea of common ancestors for living hominids including humans:               <ul style="list-style-type: none"> <li>• Fossil evidence</li> <li>• Genetic evidence: mitochondrial DNA</li> <li>• Cultural evidence: tool making</li> </ul> </li> <li>❑ List characteristics that humans share with African apes.</li> <li>❑ Tabulate anatomical differences between African apes and humans as it applies to the following characteristics:               <ul style="list-style-type: none"> <li>• Bipedalism (foramen magnum, spine and pelvic girdle)</li> <li>• Brain size</li> <li>• Teeth (dentition)</li> <li>• Prognathism</li> <li>• Palate shape</li> <li>• Cranial ridges</li> <li>• Brow ridges</li> </ul> </li> </ul>
<p><b>Out of Africa hypothesis</b></p>	<ul style="list-style-type: none"> <li>❑ State that the Out of Africa hypothesis states that all modern humans originated in Africa.</li> <li>❑ Describe how the following lines of evidence support the Out of Africa hypothesis:               <ul style="list-style-type: none"> <li>• Fossil record – by referring to fossil sites in:                   <ul style="list-style-type: none"> <li>- The Rift Valley in East Africa (Kenya and Tanzania), Ethiopia</li> <li>- South Africa</li> </ul> </li> <li>• Mitochondrial DNA</li> </ul> </li> <li>❑ Give information on each of the following fossils that serve as evidence for the Out of Africa hypothesis:               <ul style="list-style-type: none"> <li>• <i>Ardipithecus</i></li> <li>• <i>Australopithecus</i></li> <li>• <i>Homo</i></li> </ul>               with regard to:               <ul style="list-style-type: none"> <li>• The fossil sites where they were found</li> <li>• The scientists who discovered them</li> <li>• Emphasis on the evidence and evolutionary trends provided by fossils of these three genera in support of the Out of Africa hypothesis</li> </ul> </li> </ul>

<b>Human impact on the environment</b> Paper 1: 25 marks	<b>Term 4</b>	<b>2½ weeks</b>
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<b>CONTENT</b>	<b>ELABORATION</b>
<b>The atmosphere and climate change</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> State what is meant by the <i>greenhouse effect</i> and why it is important for life on Earth.</li> <li><input type="checkbox"/> Describe the sources of carbon dioxide emissions and methane emissions (greenhouse gases) which lead to the greenhouse effect.</li> <li><input type="checkbox"/> Describe how deforestation leads to an increase in the CO<sub>2</sub> concentration.</li> <li><input type="checkbox"/> State when the 'greenhouse effect' becomes known as the 'enhanced greenhouse effect'.</li> <li><input type="checkbox"/> Describe how an increase in greenhouse gases (enhanced greenhouse effect) leads to global warming.</li> <li><input type="checkbox"/> Describe how global warming may lead to desertification, drought and floods.</li> <li><input type="checkbox"/> State what is meant by <i>carbon footprint</i>.</li> <li><input type="checkbox"/> Describe ways in which we can reduce our 'carbon footprint' in order to decrease global warming.</li> <li><input type="checkbox"/> Describe the causes and consequences of ozone depletion.</li> <li><input type="checkbox"/> List ways in which we can decrease ozone depletion.</li> </ul>
<b>Water availability</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Describe how the following factors influence the availability of water: <ul style="list-style-type: none"> <li>• Construction of dams</li> <li>• Destruction of wetlands</li> <li>• Exotic plantations and depletion of the water table</li> <li>• Water wastage</li> <li>• Cost of water</li> <li>• Poor farming practices</li> <li>• Droughts and floods</li> <li>• Boreholes and its effects on aquifers</li> </ul> </li> </ul>
<b>Water quality</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Describe how each of the following factors reduce water quality: <ul style="list-style-type: none"> <li>• Eutrophication and algal bloom</li> <li>• Thermal pollution</li> <li>• Domestic use, industry, agriculture leading to pollution and disease</li> <li>• Mining</li> <li>• Alien plants, e.g. <i>Eichornia</i></li> </ul> </li> <li><input type="checkbox"/> Describe how water quality may be increased through water purification.</li> <li><input type="checkbox"/> Describe how water availability may be increased through the recycling of water.</li> </ul>
<b>Food security</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> State what is meant by <i>food security</i>.</li> <li><input type="checkbox"/> Describe how food security is influenced by each of the following factors: <ul style="list-style-type: none"> <li>• Human exponential population growth</li> <li>• Droughts and floods (climate change)</li> <li>• Alien plants and the reduction of agricultural land</li> <li>• The loss of wild varieties: impact on gene pools</li> <li>• Wastage</li> <li>• Genetically engineered foods</li> <li>• Poor farming practices such as: <ul style="list-style-type: none"> <li>- Monoculture</li> <li>- Overgrazing and the loss of topsoil</li> <li>- The use of fertilisers</li> <li>- The use of pesticides</li> </ul> </li> </ul> </li> </ul>

CONTENT	ELABORATION
<b>Loss of biodiversity</b>	<ul style="list-style-type: none"> <li>□ State the importance of maintaining biodiversity.</li> <li>□ Describe how each of the following factors may reduce biodiversity:               <ul style="list-style-type: none"> <li>• Habitat destruction through:                   <ul style="list-style-type: none"> <li>- Farming methods (overgrazing and monoculture)</li> <li>- Golf estates</li> <li>- Mining</li> <li>- Urbanisation</li> <li>- Deforestation</li> <li>- Loss of wetlands and grasslands</li> </ul> </li> <li>• Poaching (rhino horn, ivory, 'bush meat' or any other example)</li> <li>• Alien plant invasions</li> </ul> </li> <li>□ Describe how each of the following factors may reduce the loss of biodiversity:               <ul style="list-style-type: none"> <li>• Control of alien plant invasion using mechanical, chemical and biological methods</li> <li>• The sustainable use of the environment using any ONE of the following examples: devils' claw, rooibos, fynbos, the African potato (<i>Hypoxis</i>) or <i>Hoodia</i></li> </ul> </li> </ul>
<b>Solid waste disposal</b>	<ul style="list-style-type: none"> <li>□ State what is meant by <i>solid waste</i>.</li> <li>□ State why we should reduce solid waste or find ways of managing it.</li> <li>□ Describe the following aspects of solid-waste disposal:               <ul style="list-style-type: none"> <li>• The dangers associated with open dumpsites</li> <li>• Ways in which dumpsites can be managed for rehabilitation and prevention of soil and water pollution</li> <li>• The use of methane from dumpsites for domestic use, such as heating and lighting</li> <li>• The need for recycling</li> <li>• The need for safe disposal of nuclear waste</li> </ul> </li> </ul>

#### 4. CONCLUSION

This Examination Guidelines document is meant to articulate the assessment aspirations espoused in the CAPS document. It is therefore not a substitute for the CAPS document which teachers should teach to.

Qualitative curriculum coverage as enunciated in the CAPS cannot be over-emphasised.