basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

CURRICULUM AND ASSESSMENT

POLICY STATEMENT

(CAPS)

LIFE SCIENCES

GRADES 10, 11 AND 12

JUNE 2011

SECTION 1

1 NATIONAL CURRICULUM AND ASSESSMENT POLICY STATEMENT FOR LIFE SCIENCES GRADES 10 TO 12

1.1 Background

The *National Curriculum Statement Grades R – 12 (NCS)* stipulates policy on curriculum and assessment in the schooling sector.

To improve implementation, the National Curriculum Statement was amended, with the amendments coming into effect in January 2012. A single comprehensive Curriculum and Assessment Policy document was developed for each subject to replace Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R - 12.

1.2 Overview

(a) The *National Curriculum Statement Grades R – 12 (January 2012)* represents a policy statement for learning and teaching in South African schools and comprises the following:

(i) National Curriculum and Assessment Policy Statements for each approved school subject*;*

(ii) The policy document, *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R – 12; and*

(iii) The policy document, *National Protocol for Assessment Grades R – 12 (January 2012).*

(b) The *National Curriculum Statement Grades R – 12 (January 2012)* replaces the two current national curricula statements, namely the

(i) *Revised National Curriculum Statement Grades R - 9, Government Gazette No. 23406* of 31 May 2002, and

(ii) *National Curriculum Statement Grades 10 - 12 Government Gazettes, No. 25545 of 6 October 2003* and *No. 27594* of 17 May 2005.

(c) The national curriculum statements contemplated in subparagraphs (a) and (b) comprise the following policy documents which will be incrementally repealed by the *National Curriculum Statement Grades R – 12 (January 2012)* during the period 2012-2014:

(i) The Learning Area/Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines for Grades R - 9 and Grades 10 – 12;

(ii) The policy document, *National Policy on assessment and qualifications for schools in the General Education and Training Band d*, promulgated in *Government Notice No. 124* in *Government Gazette No. 29626* of 12 February 2007;

(iii) The policy document, the *National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF)*, promulgated in *Government Gazette No.27819* of 20 July 2005;

(iv) The policy document, *An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), regarding learners with special needs***,** published in *Government Gazette, No.29466* of 11 December 2006, is incorporated in the policy document, *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R – 12; and*

(v) The policy document, *An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), regarding the National Protocol for Assessment (Grades R – 12)*, promulgated in *Government Notice No.1267* in *Government Gazette No. 29467* of 11 December 2006.

(c) The policy document, *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R – 12*, and the sections on the Curriculum and Assessment Policy as contemplated in Chapters 2, 3 and 4 of this document constitute the norms and standards of the *National Curriculum Statement Grades R – 12.* It will therefore, in terms of *section 6A* of the *South African Schools Act, 1996 (Act No. 84 of 1996,)* form the basis for the Minister of Basic Education to determine minimum outcomes and standards, as well as the processes and procedures for the assessment of learner achievement to be applicable to public and independent schools.

1.3 General aims of the South African Curriculum

(a) The *National Curriculum Statement Grades R - 12* gives expression to the knowledge, skills and values worth learning in South African schools. This curriculum aims to ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. In this regard, the curriculum promotes knowledge in local contexts, while being sensitive to global imperatives.

(b) The National Curriculum Statement Grades R - 12 serves the purposes of:

- equipping learners, irrespective of their socio-economic background, race, gender, physical ability or intellectual ability, with the knowledge, skills and values necessary for self-fulfilment, and meaningful participation in society as citizens of a free country;
- providing access to higher education;
- facilitating the transition of learners from education institutions to the workplace; and
- providing employers with a sufficient profile of a learner's competences.

(c) The National Curriculum Statement Grades R - 12 is based on the following principles:

- Social transformation: ensuring that the educational imbalances of the past are redressed, and that equal educational opportunities are provided for all sections of the population;

- Active and critical learning: encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths;
- High knowledge and high skills: the minimum standards of knowledge and skills to be achieved at each grade are specified and set high, achievable standards in all subjects;
- Progression: content and context of each grade shows progression from simple to complex;
- Human rights, inclusivity, environmental and social justice: infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. The National Curriculum Statement Grades R – 12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors;
- Valuing indigenous knowledge systems: acknowledging the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution; and
- Credibility, quality and efficiency: providing an education that is comparable in quality, breadth and depth to those of other countries.

(d) The National Curriculum Statement Grades R - 12 aims to produce learners that are able to:

- identify and solve problems and make decisions using critical and creative thinking;
- work effectively as individuals and with others as members of a team;
- organise and manage themselves and their activities responsibly and effectively;
- collect, analyse, organise and critically evaluate information;
- communicate effectively using visual, symbolic and/or language skills in various modes;
- use science and technology effectively and critically showing responsibility towards the environment and the health of others; and
- demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation.

(e) Inclusivity should become a central part of the organisation, planning and teaching at each school. This can only happen if all teachers have a sound understanding of how to recognise and address barriers to learning, and how to plan for diversity.

The key to managing inclusivity is ensuring that barriers are identified and addressed by all the relevant support structures within the school community, including teachers, District-Based Support Teams, Institutional-Level Support Teams, parents and Special Schools as Resource Centres. To address barriers in the classroom, teachers should use various curriculum differentiation strategies such as those included in the Department of Basic Education's *Guidelines for Inclusive Teaching and Learning* (2010).

1.4 Time Allocation

1.1.1 1.4.1 Foundation Phase

(a) The instructional time in the Foundation Phase is as follows:

SUBJECT	GRADE R (HOURS)	GRADES 1-2 (HOURS)	GRADE 3 (HOURS)
Home Language	10	7/8	7/8
First Additional Language		2/3	3/4
Mathematics	7	7	7
Life Skills ▪ Beginning Knowledge • Creative Arts • Physical Education • Personal and Social Well-being	**6** (1) (2) (2) (1)	**6** (1) (2) (2) (1)	**7** (2) (2) (2) (1)
TOTAL	**23**	**23**	**25**

(b) Instructional time for Grades R, 1 and 2 is 23 hours and for Grade 3 is 25 hours.

(c) Ten hours are allocated for languages in Grades R-2 and 11 hours in Grade 3. A maximum of 8 hours and a minimum of 7 hours are allocated for Home Language and a minimum of 2 hours and a maximum of 3 hours for Additional Language in Grades R – 2. In Grade 3 a maximum of 8 hours and a minimum of 7 hours are allocated for Home Language and a minimum of 3 hours and a maximum of 4 hours for First Additional Language.

(d) In Life Skills Beginning Knowledge is allocated 1 hour in Grades R – 2 and 2 hours as indicated by the hours in brackets for Grade 3.

1.1.2 1.4.2 Intermediate Phase

(a) The instructional time in the Intermediate Phase is as follows:

SUBJECT	HOURS
Home Language	6
First Additional Language	5
Mathematics	6
Natural Science and Technology	3,5
Social Sciences	3
Life Skills ▪ Creative Arts ▪ Physical Education ▪ Personal and Social Well-being	**4** (1,5) (1) (1,5)
TOTAL	**27,5**

1.1.3

1.1.4 1.4.3 Senior Phase

• The instructional time in the Senior Phase is as follows:

SUBJECT	HOURS
Home Language	5
First Additional Language	4
Mathematics	4,5
Natural Science	3
Social Sciences	3
Technology	2
Economic Management Sciences	2
Life Orientation	2
Arts and Culture	2
TOTAL	**27,5**

1.1.5 1.4.4 Grades 10-12

(a) The instructional time in Grades 10-12 is as follows:

Subject	**Time allocation per week (hours)**
I. Home Language	**4.5**
II. First Additional Language	**4.5**
III. Mathematics	**4.5**
IV. Life Orientation	**2**
V. A minimum of any three subjects selected from **Group B** Annexure B, Tables B1-B8 of the policy document, *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R – 12*, subject to the provisos stipulated in paragraph 28 of the said policy document.	**12 (3x4h)**

The allocated time per week may be utilised only for the minimum required NCS subjects as specified above, and may not be used for any additional subjects added to the list of minimum subjects. Should a learner wish to offer additional subjects, additional time must be allocated for the offering of these subjects.

2

SECTION 2

2.1 WHAT IS LIFE SCIENCES?

"Life Sciences" is the scientific study of living things from molecular level to their interactions with one another and their environments. To be accepted as a science, certain methods for broadening existing knowledge, or discovering new things, are generally used. These methods must lend themselves to replication and a systematic approach to scientific inquiry. The methods include formulating hypotheses and carrying out investigations and experiments as objectively as possible to test the hypotheses. Repeated investigations are carried out and adapted. The methods and results are analysed, evaluated and debated before they are accepted as valid by the community of scientists.

Knowledge production in science is an ongoing endeavour that usually happens gradually but, occasionally, knowledge and insights take a leap forward as new knowledge, or a new theory, replaces what was previously accepted. As with all knowledge, scientific knowledge changes over time as scientists improve their knowledge and understanding and people change their views of the world around them. Scientific investigations are mostly about things that are poorly understood or not understood at all. Scientists are frequently involved in debates and disagreements. As more people work on these questions they tend to reach consensus about the way the world works. The science knowledge that is taught at school is not in doubt as most of it has been tested and has come to be generally accepted. A good teacher will tell learners something of the debates, arguments and contestations among scientists who were the first to investigate a phenomenon.

Scientists continue to explore the unknown. Why is the climate changing? What is making the universe expand? What causes the Earth's magnetic field to change? What, exactly, is the human mind? No-one knows for sure.

By studying and learning about Life Sciences, learners will develop

- their knowledge of key biological concepts, processes, systems and theories.
- an ability to critically evaluate and debate scientific issues and processes.
- greater awareness of the ways in which biotechnology and knowledge of Life Sciences have benefited humankind.
- an understanding of the ways in which humans have impacted negatively on the environment and organisms living in it.
- a deep appreciation of the unique diversity of biomes In Southern Africa, both past and present, and the importance of conservation.
- an awareness of what if means to be a responsible citizen in terms of the environment and life-style choices that they make.
- an awareness of the contributions of South African scientists
- scientific skills and ways of thinking scientifically that enable them to see the flaws in pseudo-science in popular media.
- a level of academic and scientific literacy that enables them to read, talk about, write and think about biological processes, concepts and investigations.

2.2 LIFE SCIENCES AS A SCHOOL SUBJECT

Life Sciences is the study of Life at various levels of organisation and comprises a variety of sub-disciplines, or specialisations, such as

- Biochemistry
- Biotechnology
- Microbiology
- Genetics
- Zoology
- Botany
- Entomology
- Physiology (plant and animal)
- Anatomy (plant and animal)
- Morphology (")
- Taxonomy (")
- Environmental Studies
- Sociobiology (animal behaviour)

At school level all of these sub-disciplines are introduced, to varying degrees, to provide a broad overview of the subject, Life Sciences. There are three reasons for taking Life Sciences:

- to provide useful knowledge and skills that are needed in everyday living
- to expose learners to the range and scope of biological studies to stimulate interest in and create awareness of possible specialisations
- to provide sufficient background for further studies in one or more of the biological sub-disciplines

2.3 ORGANISATION OF LIFE SCIENCES CURRICULUM.

Four "*Knowledge Strands*" are used as organisers of the Life Sciences content framework. Knowledge Strands are developed progressively over the three years of FET. These Knowledge Strands are:

- Knowledge Strand 1: Life at the Molecular, Cellular and Tissue level
- Knowledge Strand 2: Life processes in Plants and Animals
- Knowledge Strand 3: Environmental Studies
- Knowledge Strand 4: Diversity, Change and Continuity.

None of the knowledge strands, nor the topics within each knowledge strand, should be studied separately or independently. The Knowledge Strands do not need to be taught in the same sequence each year, nor do all four Knowledge Strands have to be covered in each year. They are also not weighted equally as this categorisation is simply a tool for organising the subject content. When teaching Life Sciences it is very important to help learners to see the links with related topics so that they acquire a thorough understanding of the nature and inter-connectedness of life. These links must also be made across grades.

LIFE SCIENCES: CONCEPT AND CONTENT PROGRESSION

STRANDS	LIFE AT MOLECULAR, CELLULAR AND TISSUE LEVELS	LIFE PROCESSES IN PLANTS AND ANIMALS	DIVERSITY, CHANGE AND CONTINUITY	ENVIRONMENTAL STUDIES
Grade 10	• Chemistry of Life – Inorganic and – Organic compounds • Cell – unit of life • Cell Division (mitosis) • Plant and animal tissues	• Support and transport systems in plants. • Support systems in animals • Transport systems in mammals	• Biodiversity and classification • History of Life and Earth	• Biosphere to Ecosystems
Grade 11		• Energy transformations to support life: Photosynthesis • Animal nutrition • Energy transformations : Respiration • Gas exchange • Excretion	• Biodiversity – classification of micro-organisms • Biodiversity – plants • Reproduction – plants • Biodiversity – animals	• Population ecology • Human Impact on environment: Current crises
Grade 12	• DNA code of Life • RNA and protein synthesis • Meiosis	• Reproduction in Vertebrates • Human reproduction • Nervous system • Senses • Endocrine system • Homeostasis	• Darwinism and Natural Selection • Human Evolution	

The content framework focuses on ideas, skills, concepts and connections between them, rather than on listing the facts and procedures that need to be learned. It also does not prescribe particular instructional strategies or methodologies. Instead, educators have the freedom to expand concepts and to design and organise learning experiences according to their local circumstances, including the availability of resources.

In Grade 10, all four Knowledge Strands are addressed and serve to introduce learners to the four strands.

The recommended **Grade 10** teaching sequence for the four Knowledge Strands is:
1.Life at Molecular, Cellular and Tissue level (Molecules to organs)
2. Life Processes in Plants and Animals (Processes that sustain life)
3. Environmental Studies (Biosphere to Ecosystems)
4. Diversity, Change and Continuity (History of Life on Earth)
The rationale for this order In Grade 10 is that some areas of South Africa are best suited for an environmental study during early spring and also because seasonal comparisons in a chosen ecosystem are required where possible. Some teachers may elect to deal with the Environmental Study at the beginning of the year. However it is important to retain the sequence of Knowledge Strand 1 **before** Knowledge Strand 2 and Knowledge Strand 3 before Knowledge Strand 4. Decisions regarding the sequence (starting the year with Knowledge Strands 1 and 2 or starting the year with Knowledge Strands 3 and 4) must be made by teachers.
The first section in Grade 10, called "Subject Orientation", is designed to prepare learners for the FET phase, and is intended to:

- connect what learners learned in the GET (Natural Sciences) with what they will be learning in the FET (Life Sciences). The Life Sciences subject builds on knowledge and skills acquired from the Life Sciences knowledge areas in GET.
- describe how knowledge is built/constructed in science, and introduces the scientific approach that both teachers and learners are required to use when teaching and learning Life Sciences.
- introduce learners to some basic principles related to science.
- familiarise learners with the range of skills that they will need to develop.

The orientation should be done in the first lessons as an introduction but is **not** part of the assessable curriculum although the principles and skills will be assessed **in the context** of specific content during the year. Learners will have been exposed to similar orientations at the start of the Senior Phase (Grade 7) and at the start of High School (Grade 8). The orientation on Grade 10 should then simply remind learners of what is expected of them and expand on some of the aspects.

In Grade 11, three of the four Knowledge Strands are addressed and serve to ensure progression. The content described in Life at Molecular, Cellular and Tissue level in Grade 10 is used to understand Life Processes in Plant and Animals in Grade 11 but it is not taught as a separate strand in Grade 11.

The recommended **Grade 11** teaching sequence for the three Knowledge Strands is:
1. Diversity, Change and Continuity (Microorganisms, Plants and Animals)
2. Life Processes in Plants and Animals (Processes that sustain life)
3. Environmental Studies (Population Ecology and Human Impact)

In Grade 12, three of the four Knowledge Strands are addressed and serve to ensure progression. The content described in Environmental Studies: Human Impacts (Current Crises) is dealt with in Grade 11 in order to lessen the pressure in Grade 12 but this Knowledge Strand will be examined in the National Senior Certificate examination at the end of Grade 12.

The recommended **Grade 12** teaching sequence for the four Knowledge Strands is:
1. Life at Molecular, Cellular and Tissue level (DNA and protein synthesis)
2. Life Processes in Plants and Animals (Processes that sustain life)
3. Diversity, Change and Continuity (Darwinsim and Human Evolution)

4. Environmental Studies (Human Impact, taught and assessed in Grade 11)

The identified range of cognitive and practical skills must be taught, and assessed, in an integrated way in the context provided by the topics in the four Knowledge Strands in each year in the FET band.

2.4 PURPOSE OF STUDYING LIFE SCIENCES

- **Development of scientific knowledge and understanding**

Scientific knowledge and understanding can be used to answer questions about the nature of the living world around us. It can prepare learners for economic activity and self-expression. It lays the basis of further studies in science and prepares learners for active participation in a democratic society that values human rights and promotes acting responsibly towards the environment.

- **Development of science process skills (Scientific Investigations)**

The teaching and learning of science involves the development of a range of process skills that may be used in everyday life, in the community and in the workplace. Learners can gain these skills in an environment that supports creativity, responsibility and growing confidence. Learners develop the ability to think objectively and use a variety of forms of reasoning while they use process skills to investigate, reflect, synthesise and communicate.

- **Development of an understanding of the roles of science in society**

Both Science and technology have made a major impact, both positive and negative, on our world. Careful selection of scientific content, and use of a variety of ways of teaching and learning science, should promote understanding of science as a human activity as well as the history of science and the relationship between Life Sciences and other subjects. It also helps learners to understand the contribution of science to social justice and societal development as well as the need for using scientific knowledge responsibly in the interest of ourselves, of society and the environment. Understanding science also helps us to understand the consequences of decisions that involve ethical issues.

2.5. SPECIFIC AIMS

There are **three** broad subject-specific aims in Life Sciences which relate to the purposes of learning science. . These are

1. Specific Aim 1, which relates to the knowing of the subject content ("theory").
2. Specific Aim 2, which relates to doing science or practical work and investigations.
3. Specific Aim 3, which relates to understanding the applications of Life Sciences in everyday life, as well as understanding the history of scientific discoveries and the relationship between indigenous knowledge and science.

WHAT DO THE THREE AIMS MEAN AND HOW DO THEY RELATE TO ASSESSMENT?

2.5.1 SPECIFIC AIM 1: KNOWING LIFE SCIENCES (Life Sciences concepts, processes, phenomena, mechanisms, principles, theories, laws, models, etcetera).

This involves knowing, understanding, and making meaning of sciences in a way that enables learners to make many connections between the ideas and concepts in their minds. Making such

connections makes it possible for learners to apply their knowledge in new and unfamiliar contexts. The process of acquiring a deep understanding of Science is about more than just knowing a lot of facts. The scope of the knowledge that learners should acquire includes knowledge of the process skills related to carrying out investigations.

The following cognitive (thinking) skills comprise the **range** of skills that all learners should develop in the context of working through the curriculum in a school year. These skills also indicate what should be assessed, **at the appropriate grade level**, in a variety of different kinds of assessments during the year. Note that not every skill will be assessed in every assessment, but teachers must ensure that, by the end of the year, the assessments provide evidence that learners have been assessed on all of these.

2.5.1.1 ACQUIRE KNOWLEDGE

In the process of acquiring knowledge learners must…

- **access** information from a variety of sources (teachers, reference books, textbooks, internet, experts, peers, parents, etcetera).
- **select** key ideas.
- **recall** facts
- **describe** concepts, processes, phenomena, mechanisms, principles, theories, laws, models in the Life Sciences.

Assessment

In order to assess these competences (or cognitive skills), teachers should use the following verbs in the tasks or assessments that they set: state, name, label, list, define, describe and any other verbs that would show that **knowledge** of the subject is being assessed.

2.5.1.2 UNDERSTAND, COMPREHEND, MAKE CONNECTIONS BETWEEN IDEAS AND CONCEPTS TO MAKE MEANING OF LIFE SCIENCES

In the process of making meaning and achieving understanding learners must…

- **build a conceptual framework** of science ideas.
- **organise** or **reorganise** knowledge to derive new meaning
- **write** summaries
- **develop** flow charts, diagrams and mind maps
- **recognise** patterns and trends

Assessment

In order to assess these competencies (cognitive skills), teachers should use the following verbs in the tasks or assessments they set: explain, compare, rearrange, give an example of, illustrate, calculate, interpret, suggest a reason, make a generalisation, interpret information or data, predict, select, differentiate or any other suitable verbs which would indicate that understanding of the subject is being assessed.

2.5.1.3 APPLY KNOWLEDGE OF LIFE SCIENCES IN NEW AND UNFAMILIAR CONTEXTS

Learners must be able to…

- **use** information in a new way.
- **apply** knowledge to new and unfamiliar contexts

Assessment

In order to assess these competencies (cognitive skills), teachers should use the following verbs in the tasks or assessments that they set: demonstrate, interpret, predict, compare, differentiate, illustrate, solve and select, as well as any other appropriate verbs which would assess a learner's ability to apply knowledge. The key is that the learners will have to apply knowledge about something that they have learnt, and which they understand, in a context or situation about which they have not yet acquired specific knowledge, or they must use the knowledge in a new way.

2.5.1.4 ANALYSE, EVALUATE AND SYNTHESISE SCIENTIFIC KNOWLEDGE, CONCEPTS AND IDEAS

In the process of learning science learners must be able to…

- **analyse** information/data
- **recognise** relationships between existing knowledge and new ideas.
- **critically** evaluate scientific information
- **identify** assumptions
- **categorise** information

Assessment

In order to assess these competencies (cognitive skills) teachers should use the following verbs in the tasks or assessment that they set: appraise, argue, judge, select, evaluate, defend (a point of view), compare, contrast, criticise (an argument or assumption) differentiate, distinguish, discuss or any other suitable verbs that would indicate that analysis, evaluation and synthesis have been assessed.

2.5.2 SPECIFIC AIM 2: INVESTIGATING PHENOMENA IN LIFE SCIENCES

Learners must be able to plan and carry out investigations as well as solve problems that require some practical ability. This ability is underpinned by an attitude of curiosity and an interest in wanting to find out how the natural world and living things in it work.

The following range of skills relate to **doing** practical work in Life Sciences. All seven skills will not apply to every activity equally. The skills are aligned to what learners would be doing in the normal course of carrying out an investigation. Teachers must select those skills that apply to, and which can be assessed in, the context of specific activities. By the end of each year in the FET phase, all seven skills must have been assessed at a **grade-appropriate** level.

Note:

Whilst **doing** practical investigations involves a specific range of skills, knowledge and understanding of doing science can, and should, be assessed within the context of the cognitive domains of Specific Aim 1.

Learners must be able to:

2.5.2.1. FOLLOW INSTRUCTIONS

This is essential, especially in the lower grades and in large classes. Teachers cannot expect all learners to use unfamiliar equipment and to do so independently without giving them a clear set of instructions to follow. The amount of assistance required would indicate the level of performance in this regard. Adherence to safety rules would be part of this.

2.5. 2.2. HANDLE EQUIPMENT OR APPARATUS

This should include knowledge of the apparatus, that is, naming it and knowing what it is used for. It includes using a variety of different kinds of equipment. "Handling equipment" is a generic skill and would apply to any equipment used for many different kinds of investigations. Handling improvised equipment requires the same skills as would be required for handling standard laboratory equipment. The emphasis is on **using** equipment appropriately and safely (and not on memorising the names of apparatus only.)

2.5.2.3. MAKE OBSERVATIONS

A variety of different kinds of observations are possible and observations can be recorded in different ways, such as:

- drawings.
- descriptions.
- grouping of materials or examples based on observable similarities and/or differences.
- measurements.
- comparing materials before and after treatment.
- observing results of an experimental investigation which will involve recording information in an appropriate way.
- counting.

2.5.2.4. RECORD INFORMATION OR DATA

This should include recording observations or information as drawings, descriptions, in simple table format, as simple graphs, etcetera. Again, the skill of "recording" is transferable across a range of different scientific activities.

2.5.2.5. MEASURE

Learners should know **what** to measure, **how** to measure it and have a sense of the degree of accuracy that is required. A variety of things could be measured including (but not limited to)

length, volume, temperature, weight or mass, numbers (counting). Measuring is a way of quantifying observations and in this process learners should learn to make estimations.

2.5.2.6. INTERPRET

Learners should be able to convert information from one form in which it was recorded, for instance a table, into, for example, an appropriate graph.

Learners should be able to perform **appropriate** simple calculations, to analyse and extract information from tables and graphs, apply knowledge of theory to practical situations, recognise patterns and/or trends, appreciate the limitations of experimental procedures and make deductions based on evidence.

2.5.2.7. DESIGN/PLAN INVESTIGATIONS OR EXPERIMENTS

Not all investigations are based on the "classic" dependent-independent variables and controls. For example, an investigation could involve observing soil profiles or counting populations.

Designing an investigation is a different process from planning an investigation. In the design process options need to be considered depending on the hypothesis and variables may have to be identified.

Skills include:

- identifying a problem.
- hypothesising.
- selecting apparatus or equipment and/or materials.
- identifying variables
- suggesting ways of controlling variables
- planning an experiment.
- suggesting ways of recording results.
- understanding the need for replication or verification.

In Grade 10, learners must begin to be able to plan and/or design a simple investigation or experiment.

Note: Skills 2.5.2.1 to 2.5.2.6 (following instructions, handling equipment, making observations, recording information, measuring and interpreting information) would all be required, in one form or another, in order to carry out an experiment or investigation.

By separating seven different kinds of skills (2.5.2.1 to 2.5.2.7), these skills can apply to the **variety** of different kinds of practical work that is appropriate for a particular grade in Life Sciences, including simple investigations or experiments. This approach makes it easier to assess learners in a range of different circumstances and it enables a teacher to judge a learner's ability to **do** science. The skills are based on what learners would do in the normal course of doing practical work. However, there are some circumstances in which only some of these skills would apply and not every skill can be assessed in every practical task.

2.5.3 SPECIFIC AIM 3: APPRECIATING AND UNDERSTANDING THE HISTORY, IMPORTANCE AND APPLICATIONS OF LIFE SCIENCES IN SOCIETY

The third aim of Life Sciences is to enable learners to understand that school science can be relevant to their lives outside of the school and that it enriches their lives.

Learners must be exposed to the history of science and indigenous knowledge systems from other times and other cultures. Scientific knowledge and understanding have been developed over time by people who were curious and who persevered with their quest for knowledge. Our present understanding of science will change and will be improved by modern scientists making new discoveries.

The skills that can be developed in the process of achieving Specific Aim 3 are cognitive rather than practical skills. These are the same cognitive skills as the ones identified for Specific Aim1.

Because knowledge that will be acquired in respect of Specific Aim 3 always relates to specific subject content, the content provides the context for learning about various aspects of Science in society. It should therefore be taught in an integrated way in order to both enhance the subject and to clarify the relationship between the subject and society i.e. indigenous knowledge systems that relate to a specific topic, related history of scientific discoveries and the applications of science in everyday life.

2.5.3.1 UNDERSTANDING THE HISTORY AND RELEVANCE OF SOME SCIENTIFIC DISCOVERIES

The subject content provides the context for learning about the history of scientific discoveries and their relevance for society. These aspects, the history and relevance, should be linked to and taught with the topics and content that are relate to a particular discovery or a particular scientist.

2.5.3.2. RELATIONSHIP OF INDIGENOUS KNOWLEDGE TO LIFE SCIENCES

All knowledge grows out of a view of how the world works. One of the differences between modern science (and technology) and traditional, indigenous knowledge systems is that they have their origins in different world views. Learners should understand the different cultural contexts in which indigenous knowledge systems were developed.

Examples of indigenous knowledge that are selected for study should, as far as possible, reflect different South African cultural groupings. They **will** also link directly to specific areas in the Life Sciences subject content.

2.5.3.3 THE VALUE AND APPLICATION OF LIFE SCIENCES KNOWLEDGE IN INDUSTRY, IN RESPECT OF CAREER OPPORTUNITIES AND IN EVERYDAY LIFE

This is about the applications and relevance that knowledge of Life Sciences has found in various aspects of society. Examples should be relevant to the subject content that learners are dealing with at a particular time. For example, there are career opportunities in respect of socio-biology and animal behaviour, plant pathology, game management, environmental impact studies, preservation of biodiversity, palaeontology, paleoanthropology, agriculture, horticulture,

environmental law, science journalism, biotechnology, genetic engineering, and many others. Learners should be made aware of careers, but these should not be discussed or taught in great detail.

Skills

Whilst the kind of knowledge is different for Specific Aims 1 and 3, the content should be taught in an integrated way in order for learners to more easily understand the history, relevance and applications of science. Importantly, the skills that must be developed and assessed for Specific Aim 3 are the same as those of Specific Aim 1.

Learners must

- **access** information.
- **select** key ideas.
- **recall** information
- **describe** knowledge of natural sciences.

Specific Aim 1.1

- **build a conceptual framework.**
- **organise** or **reorganise** knowledge
- **write** summaries
- **develop** flow charts and mind maps
- **recognise** patterns and trends

Specific Aim 1.2

- **apply** knowledge in new contexts.
- **use** knowledge in a new way
- **analyse** information/data

Specific Aim 1.3

- **critically evaluate** scientific information
- **recognise** relationships between existing knowledge and new ideas
- **identify** assumptions
- **categorise** information

Specific Aim 1.4

The three aims are aligned to the three Learning Outcomes with which teachers are familiar. Within each of these aims, specific skills or competences have been identified. It is not advisable to try to assess each of the skills separately, nor is it possible to report on individual skills separately. However, **well designed assessments** must show **evidence** that, by the end of the year, all of the skills have been assessed **at a grade-appropriate level**. There must be a clear link between the aims and the outcomes of learning. The processes of teaching, learning and assessment will provide the links between the Specific Aims and the achievement of the outcomes.

2.5.4 DEVELOPING LANGUAGE SKILLS: READING AND WRITING

Teachers of Life Sciences should be aware that they are also engaged in teaching language across the curriculum. This is particularly important for learners for whom the Language of Learning and Teaching (LoLT) is not their home language. It is important to provide learners with opportunities to develop and improve their language skills in the context of learning Life Sciences. It will therefore be critical to afford learners opportunities to read scientific texts, to write reports, paragraphs and short essays as part of the assessment, especially (but not only) in the informal assessments **for** learning.

2.6 TIME

The time allocation for Life Sciences is 4 hours per week in Grades 10 to 12.

The curriculum for **Grade 10** has been designed to be completed within 32 weeks out of 40 weeks in the school year. This leaves 8 weeks in the year for examinations, tests and disruptions due to other school activities.

The curriculum for **Grade 11** has been designed to be completed within 32 weeks out of 40 weeks in the school year. This leaves 8 weeks in the year for examinations, tests and disruptions due to other school activities.

The curriculum for **Grade 12** has been designed to be completed within 27½ weeks out of 40 weeks in the school year. This leaves 12½ weeks in the year for examinations, tests and disruptions due to other school activities.

In Grades 10, 11 and 12 the time allocated for the teaching of the content **includes the practical tasks and investigations. These are an integral part of the teaching and learning process.**

2.7. RESOURCES

The resources needed for teaching Life Sciences are listed against each topic in order to assist teachers with planning and preparation.

Every learner must have his/her own textbook. Teachers should ensure that a system is in place for recovering textbooks at the end of every year. Schools must provide secure storage space where textbooks, and other equipment, can be stored safely.

Ideally every learner should have access to sufficient workspace and equipment to carry out investigations. For safety reasons no more that three learners may share space and equipment in instances where space and equipment are limited due to large classes. With regard to equipment, schools must make every effort to ensure that the essential equipment is provided.

Whilst it is acknowledged that it is not ideal to have to improvise equipment, teachers should remember that it is more important for learners to have the experience of carrying out a variety of investigations than to depend on the availability of standard laboratory equipment. In instances where equipment is limited, teachers should be encouraged to improvise. The same skills can be developed using improvised equipment. Also if there are no alternatives, it is more effective for teachers to demonstrate an investigation that to not do investigations due to a lack of equipment. Secure storage for equipment and chemicals must be provided by the school.

Teachers should ensure that learners are familiar with rules regarding the safe use of equipment and chemicals. The Life Sciences classroom or laboratory should be equipped with charts, Bunsen burners or spirit lamps, handlenses, bioviewers and relevant biostrips, microscopes, a set of prepared slides, glass slides and cover slips, reference books, blades or scalpels, models, Field Guides, identification keys, thermometers, glass beakers, test tubes and chemicals, and, if at all possible, access to appropriate DVDs and a DVD player.

Fresh plant material can be obtained from the surroundings and teachers should ensure that appropriate plants (eg Impatiens) are planted on the school grounds. Fresh animal material can very often be obtained at reasonable cost from the local butcher.

Teachers must be qualified to teach the subject and must familiarise themselves with the equipment and how it is used.

SECTION 3

LIFE SCIENCES: GRADE 10: CONTENT

The first part of the Curriculum in Grade 10, called "Subject Orientation" is included to prepare learners for Life Sciences in the FET band, is intended to:

- familiarise learners with the way the teacher will organise learning activities.
- familiarise learners with the behaviour that will be required and rules of safety.
- connect what learners have learnt in the Senior Phase with what they will learn, and the range of skills that they must develop, in FET.
- Describe how knowledge is constructed in Life Sciences and to confirm a scientific approach that both teachers and learners will be required to use when teaching and learning Life Sciences.
- Introduce learners to some basic principles related to Life Sciences

TERM 1	
TIME	**ORIENTATION TO LIFE SCIENCES: SUBJECT ORIENTATION**
½ Week (2 hours)	Establish links between Natural Sciences (GET) and Life Sciences (FET). Define life, its scope, and its continuity. Life on earth is dynamic, with homeostasis maintaining balance at every level of organisation. Life is characterised by changes over billions of years. Living systems exhibit levels of organisation from molecules to biomes. The nature of science: contested knowledge, non-dogmatic, inferences based on evidence, peer review. **How science works:** • fundamental knowledge built on scientific evidence and verifying findings (articles are published in journals or at conferences: peer review) • observing • investigating • making measurements and the importance of scaling • collecting and presenting data in the form of drawings, written descriptions, tables and graphs • understanding the limitations of scientific evidence • identifying patterns and relationships in data • communicating findings • societal aspects of scientific evidence

	Scientific skills: • importance of biological principles such as relationship between surface area and volume/size, the relationship between structure and function • biological drawings: principles that apply • translating 3 dimensional objects or specimens into 2 dimensional drawings and photographs and interpreting 2 dimensional drawings and photographs: transverse and longitudinal sections • general introduction to the range of skills listed under the Specific Aims that must be developed • introduction to graphs: different kinds of graphs and when to use them; interpreting graphs. • calculating **Organisation of learning and rules:** • using equipment and other resources • laboratories, classrooms: procedures, apparatus, chemicals: safety • working in groups • assessment requirements • Very brief mention of careers and subject combinations for entrance to Higher Education. **Note:** This introduction is not assessable. However, the relevant aspects must be incorporated into in the context of the specific content where they apply, and will then be assessed.

TERM 1				
STRAND 1: LIFE AT THE MOLECULAR, CELLULAR AND TISSUE LEVEL All living organisms are made of atoms which combine to form molecules, and these make up the basic units of life i.e. cells. Plant and animal cells have a complex organisation which enables them to carry out the basic processes of life, i.e. movement (movement in and around the cells and some cells move), nutrition (cells produce food or obtain food from elsewhere), respiration, excretion, growth, reproduction and responding to stimuli. Cells are specialised and form tissues which perform particular functions. The tissues are arranged in organs which are also specialised to carry out particular functions. This strand introduces learners to life at the molecular, cellular, tissue and organ level. (Links to Grade 9).				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
2½ weeks (10 hours)	**The chemistry of life**	**Molecules for life:** Organic molecules made up of C, H, O and some also contain other elements, e.g. N and P. Cells are made up of proteins, carbohydrates, lipids, nucleic acids and vitamins. (Only basic structural detail required.) **Inorganic compounds** • Water: 2 H and 1 O • Minerals: e.g. Na, K, Ca, P, Fe, I, nitrates, phosphates. Macro and micro elements. Main functions and deficiency diseases *(link to nutrition and Grade 9)* • Need for fertilisers in over utilised soils e.g. where crops are grown and regularly harvested, problem of fertilizers washed into rivers, and eutrophication. *(Link to ecology)* **Organic compounds** • Carbohydrates – monosaccharides (single sugars) e.g. glucose, fructose; disaccharides, (double sugars) e.g. sucrose, maltose; polysaccharides (many sugars) e.g. starch, cellulose, glycogen • Lipids (fats and oils) – 1 glycerol and 3 fatty acids: unsaturated and	Optional: Construct models of simple and more complex molecules using beads or plasticine. Analyse nutritional content on food packaging: vitamins, minerals and other nutritional content. **Essential:** Food tests for starch, glucose, lipids and proteins.	Textbook Charts Equipment Test tubes Selection of Food packaging showing nutritional content Chemicals Bunsen burners Thermometers Washing powder

		saturated fats. Cholesterol in foods. Heart disease *(link to Grade 9).* • Proteins – amino acids. (C,H, O and N and some have P, S, Fe) Proteins are sensitive to temperature and pH: loss of structure and function. Role of enzymes in breaking down/synthesising molecules. Influence of temperature and pH on enzyme action. Lock and key model of how enzymes work. Enzymes in everyday life, e.g. washing powders. • Mention of Nucleic acids: DNA and RNA – Consisting of C, H, O, N and P (No details of structure required). • Vitamins: e.g. A, one of B vitamins, C, D and E *(Simple diagrams to represent molecules. Review briefly why these substances are needed in plants and animals i.e. build on prior knowledge. No detail of structure or function - functions will be dealt with in later sections where appropriate. This is a brief introduction to the molecules making up organisms)*	Investigation to test the working of a "biological" washing powder (with enzymes). or Hydrogen Peroxide and chicken liver to demonstrate effect of enzyme. or Fresh pineapple juice, solid egg white in plastic drinking straw. Observe, measure and record results of the experiment done at different temperatures. Compare Recommended Daily Allowance (RDA) with usual diet of individual learners. Draw a pie chart of the food types and discuss implications of the usual diet of learners.	or H_2O_2 and chicken liver or pineapple juice, egg white, plastic drinking straws

3 weeks (12 hours)	**Cells: the basic units of life**	• Molecular make-up: Cells are mostly made of proteins, carbohydrates, lipids, nucleic acids and water Brief overview of the history of microscopy: from lens, to light and then electron microscopes that enabled people to see cells and then structures within cells which led to cell theory. *(Briefly revise Grade 9 work on cell).* **Cell structure and function: roles of organelles** • Cell wall – support structure in plant cells only. • Cell membrane – fluid mosaic model, boundaries and transport: Movement across membranes**:** diffusion, osmosis and active transport. • Nucleus, chromatin material, nuclear membrane, nucleopores, nucleolus: the control centre, heredity. • Cytoplasm – storage, circulation of materials • Mitochondria – release of energy during cell respiration • Ribosomes – protein synthesis • Endoplasmic reticulum (rough and smooth) - transport systems • Golgi body –assemble secretions • Plastids – production and storage of food, pigments • Vacuole, lysosomes, vesicles – storage, digestion, osmoregulation. Relate structure and location of organelles to their functions. *(This is an introduction; some organelle functions will be explored in more detail in other sections.)* **Cells differ** in size, shape and structure in order to carry out specialised functions *[link to tissues]* Differences between plant and animal cells *(link to Grade 9)*	• Explain and demonstrate how a light microscope works. • Observe and record (draw) the structure of a - Plant cell (wet mount of onion epidermis) - Animal cell (cheek cells) using a light microscope. If microscopes are not available, use micrographs. - Calculate magnification of drawing by measuring the field of view under a microscope or - calculate the size of specimen on a micrograph using the scale line provided • Investigate diffusion • Investigate osmosis	Textbook Charts Micrographs Microscope slides Chemicals Electron micrographs (in text books) Transparent ruler Bioviewers and biostrips Beakers, salt, potatoes or eggs.

2weeks (8 hours)	**Cell division-mitosis**	• **The cell cycle including mitosis:** interphase, mitosis (with names of phases) cytokinesis, growth. Continuous process of mitosis: Division of cell to form two identical cells *(Simple description with diagrams to show chromosome changes so that one parent cell forms **two identical** daughter cells)* - Difference in telophase between plant and animal cells **Chromosomes:** In nuclei of all cells, two chromatids, centromere **Role of mitosis:** Growth and repair. Reproduction in some simple organisms **Cancer:** Uncontrolled cell division and growth: Causes of cancer -Brief discussion of beliefs and attitudes concerning cancer -Treatments of cancer -Medical biotechnology e.g. radiotherapy, chemotherapy (no detail required)	Use suitable resources to examine cell division e.g. microscope slides, micrographs, posters, models Record observations as drawings Research and present information on ONE of the cancers. This must include causes, prevalence and treatment. Information can be presented verbally or as a written report.	Textbook Charts Micrographs/microscope slides Microscope Reference books
1 week (4 hours) **Total 9 weeks (36 hours)**	**Plant and animal tissues**	Introduce concept of a tissue as a group of similar cells adapted for a particular function: cell differentiation **Tissues:** Emphasis on the relationship between basic structure and function. Plant tissues: xylem, phloem, parenchyma, collenchyma, sclerenchyma, epidermis and meristematic tissue	Examine and identify some plant tissues using microscope, biostrips, micrographs or posters. Draw cells that make up these tissues to show specialised structure.	Textbook Charts Microscope slides Micrographs Microscope
ASSESSMENT		1 formal, recorded class test. Assessment for learning (informal) using a variety of strategies and appropriate forms of assessment in tests, homework exercises, worksheets, reports, summaries, essays, etc.	1 Practical task	

	Refer to the range of skills listed under Specific Aims 1 and 3. Note that knowledge and understanding to investigations and practical work should also be assessed in written worksheets, reports, homework exercises and tests. The cognitive skills listed under Specific Aims 1 and 3 will also apply to knowledge and understanding of investigations.	Refer to range of skills specified under Specific Aim 2	

TERM 2				
STRAND 1:LIFE AT MOLECULAT CLELLULAR AND TISSUE LEVEL (continued)				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
2 weeks (8 hours)	**Plant and animal tissues (continued)**	• Animal tissues: 4 basic types - epithelial - connective - muscle and - nerve tissue and some examples of each. Relationship between structure and function [No detail required – some tissues, e.g. blood and nerves in the reflex arc, will be covered in more detail in relevant sections] Applications of indigenous knowledge systems and biotechnology • Traditional technology e.g. traditional medicines and healers • Medical biotechnology e.g. immunity, vaccines, antibiotics, blood transfusion • Cloning of plant and animal tissues and stem cell research; ethics and legislation:	Examine and identify some animal tissues using microscope, biostrips, micrographs or posters. Draw cells that make up these tissues to show specialised structure. Collect information on ONE field of biotechnology related to plant or animal tissues e.g. cloning, stem cell research, in vitro fertilisation.	Textbook Charts Microscope slides/micrographs Microscope Reference books
½week (2 hours)	**Organs**	Organs consist of a number of tissues. Leaf structure will be used as an example of an organ. Other organs will be dealt with in their relevant sections in life processes.	Observe and draw a section of a dicotyledonous leaf	Textbook Charts Micrographs/

		Leaf structure: Cross section of a dicotyledonous leaf to demonstrate and explain its structure in terms of its functions i.e. photosynthesis, gas exchange and transport. Link with plant tissues, appropriate cell organelles, movement across membranes and movement of molecules into, through and out of the leaf.	**Options:** -use prepared slides of cross section of a leaf. or use micrographs. or use bioviewer slide strips	microscopes micrographs/ bioviewers
STRAND 2: LIFE PROCESSES IN PLANTS AND ANIMALS. Learners explore the anatomy of plants and animals in respect of support and transport systems. In animals, the different support systems are compared, with a focus on the human support system and locomotion				
3 weeks (12 hours)	**Support and transport systems in plants.**	• Anatomy of dicotyledonous plants: *(link to Grade 7)* – root and stem: distribution of different tissues – structure of cells in different tissues *(link to plant tissues)* – secondary growth *(link to cell division);* annual rings in a tree trunk to assess age and to infer climate change • **Transpiration**: relationship between water loss and leaf structure *(link to Term 1)*, Factors that affect the rate of transpiration: – temperature – light intensity	• Use a microscope or micrographs to observe and draw cross sections of root and stem (plan only). • If microscopes available make mounts of, and draw, whole xylem vessels from celery or pumpkin stalks to see secondary thickening patterns • Observe annual rings in a cut tree to assess age and climatic conditions • Design an investigation to discover the effect of temperature, light intensity or humidity on transpiration rate. (using a simple potometer). Identify variables and control	Textbook Microscopes Prepared slides Glass slides Cover slips Pumpkin or Celery stems Blade or Scalpel Coloured ink/food colouring Potometer Beakers Leafy twigs

		– wind – humidity • Wilting and guttation • Uptake of water and minerals into xylem in roots in xylem. • Transport of water and minerals to leaves • Translocation of manufactured food from leaves to other parts of plant	variables. • Investigate water uptake through the roots • Investigate water movement through xylem (use *Impatiens* if possible).	Soft plant e.g. Busy Lizzie/Impatiens Eosin Glass containers
3 weeks (12 hours)	**Support systems in animals**	• **Skeletons:** Examples of animals with each of the following: - hydrostatic skeleton - endoskeleton - exoskeleton: Advantages and disadvantages Emphasise developmental progression and relate to the need for support linked to a terrestrial lifestyle. • **Human skeleton**: – the axial skeleton: mention of facial bones, cranium, foramen magnum, palate and jaws (*to link with human evolution in Grade 12)* – appendicular skeleton • **Functions of skeleton:** - Movement - Protection - Support - Storage of minerals - Hearing • Structure of a long bone	• Observe human skeleton (model or photographs). • Observe and draw a typical	Textbook Model Photographs Selection of cut long bones (from

			longbone: longitudinal section	butchery)
		• Relationship between structure and function of the following tissues: mention of - bone, cartilage, tendons, ligaments.	• Observe as many of these tissues as possible: fresh material from a butcher.	Obtain material from a butcher: Joint with bone, cartilage ligaments or Microscope Prepared slides or Micrographs
		• Joints: - fixed - partly movable - freely movable (synovial). Structure of synovial joints: ball and socket, hinge, pivot and gliding. • Roles of the following in human locomotion: - bones - joints - ligaments - tendons - antagonistic muscles (e.g. biceps/triceps). • Structure of voluntary skeletal muscle: myofibrils and muscle contraction. • Diseases that affect the skeleton, e.g. rickets in children, osteoporosis, arthritis.	• Observe and describe the movement which occurs at each of these types of joints. If possible: X-ray of ball and socket and hinge joints.	X rays if possible
Total 8½ weeks (34 hours)				

ASSESSMENT	1 formal, recorded class test. Mid-year examination (2½hrs). Refer to the range of skills specified in Specific Aims 1 and 3. Assessment for learning (informal) using a variety of strategies and appropriate forms of assessment in homework exercises, written worksheets, reports, summaries, essays, tests, etc. Note that knowledge and understanding of investigations and practical work should also be assessed in written worksheets, homework exercises, reports, tests, essays and examinations. The cognitive skills listed under Specific Aim 1 and 3 will also apply to knowledge and understanding of investigations.	1 practical task. Refer to the range of skills specified in Specific Aim 2.

TERM 3				
STRAND 2: LIFE PROCESS IN PLANTS AND ANIMALS (continued)): Learners study the transport system of the human body.				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
3 weeks (12 hours)	**Transport systems in mammals (human)**	**Circulatory system** • **Blood circulation system:** pulmonary and systemic (double, closed) circulatory systems – heart and associated blood vessels – heart: internal and external structure related to functioning – cardiac cycle: flow of blood through the heart • Direction of blood flow: difference between oxygenated and deoxygenated blood in different parts of the system (diagram or schematic drawing) - Lungs and pulmonary system; associated blood vessels - major organs and systemic system: associated major blood vessels of brain, small intestine, liver, kidneys • Mechanisms for controlling cardiac cycle and heart rate (pulse) • Blood vessels: structure and functioning of arteries, veins with valves and capillaries. • **Lymph**: relationship between blood system and lymphatic system. Functions of lymphatic system • Mention of diseases of heart and circulatory	• Dissection of mammal heart (sheep, cow or pig) obtained from a butchery. Identify chambers, valves, muscle, blood vesels. • In pairs, measure the pulse of one learner before and after exercise. Record, interpret and explain data presented as a graph. • Observe and draw prepared microscope slides or micrographs of blood cells and blood vessels as seen in cross section. • Draw up a table of differences between different types of blood vessels	Textbook Charts Sheep, cow or pig heart obtained from a butchery. Scalpel or blade Stop watch or cell phone clock Microscope Prepared slides or Micrographs

		system: high and low blood pressure, heart attacks, strokes. Treatments of heart diseases eg. stents, valve replacements, bypass surgery, pacemakers, heart transplant.		

STRAND 3: ENVIRONMENTAL STUDIES

Organisms interact with other organisms and with the environments in which they live in order to survive and produce offspring. The study of these interactions is called ecology. This section is structured so as to expose learners to some of the interactions that occur in nature and to the terminology and concepts that describe them. The terminology and concepts selected here will be used in Grade 11 across all strands, where appropriate. It also enables learners to contextualise the meaning of these terms and concepts within the familiar contexts of both southern Africa and the local area. The local area context is also used to introduce human influences on the environments in which they and other organisms live. This will be expanded on in more detail within local and global influences and the effect man has had on the environment in Grade 11. This section builds on the knowledge that has been acquired in the Senior Phase.

TIME	TOPIC	CONTENT	INVESTIGATIONS	RESOURCES
6 weeks (24 hours)	**Biosphere to Ecosystems**	• **Biosphere** Concept of the biosphere. Inter-connectedness with and components of global ecosystem: hydrosphere, lithosphere, atmosphere *(Links to Grade 8)* • **Biomes** Terrestrial and aquatic biomes of Southern Africa: how climate, soils and vegetation influence the organisms found in each. Location of the different biomes in South Africa. • **Environment** Concept of environment to show human activities in and interactions with the natural environment Abiotic and biotic factors: Effects on the community.	**Fieldwork**	Textbook Field guides Keys Access to an ecosystem Map of South Africa DVD's The Internet Nature programmes on TV Local information Appropriate instruments for measuring abiotic factors.

Total: 9 weeks (36		• **Ecosystems** Concept of ecosystem. Structure and ecosystem functioning: **Abiotic factors:** – physiographic factors (aspect, slope, altitude) – soil (pH, humus content, texture, water retention capacity, air content) – light (day length, seasonal changes) – temperature (effect of day/night, seasons) – water (water cycle, importance of wetlands) – atmospheric gases *(link to pollution-Grade 12)* – wind (link to transpiration) • **Biotic factors:** *(Links to Grade 8)* – producers – consumers – decomposers • Energy flow through ecosystems and relationship to trophic structure (food pyramids): – Trophic levels: producers, consumers (herbivores and carnivores and omnivores , decomposers *(link with grade 9 and nutrition in grade 11)* – Flow charts of the following: nutrient water, oxygen, carbon and nitrogen cycles (Names e.g. nitrates are required but no detail of chemistry is necessary)	**Choose ONE ecosystem (close to the school) within a local biome for special study. The study must deal with all of the following:** • abiotic and biotic factors and the interactions between them. • trophic relationships in an ecosystem • record and describe seasonal changes over 2 terms; either term 1 and 2 or term 3 and 4 • biodiversity within the ecosystem using field guides and keys • positive and/or negative human impact/influence on the ecosystem Different groups should investigate different factors. Each group must plan, collect, record and present, analyse and evaluate data. *(This serves as an introduction/link to human influences on the environment in Grade 11.)*	

hours)		• **Ecotourism:** economics, ethics and opportunities		
Assessment		1 formal, recorded class test. Assessment for learning (informal) using a variety of strategies and appropriate forms of assessment in written worksheets, homework exercises, summaries, reports, essays, etc. Refer to range of skills specified in Specific Aims1 and 3. Note that knowledge and understanding of investigations and practical work should also be assessed in written worksheets, reports, homework exercises and tests. The cognitive skills listed under Specific Aims 1 and 3 will also apply to knowledge and understanding of investigations.	1 practical task Refer to the range of skills specified under Specific Aim 2.	

TERM 4				
STRAND 4: **DIVERSITY, CHANGE AND CONTINUITY** Life exists in a huge array of forms and modes of life at present, which scientists organise according to man-made classification systems. Modern life forms have a long history, extending from the first cells, around 3.5 billion years ago. South Africa has a rich fossil record of some key events in the history of life. Changes in life forms are related to climate changes as well as movements of continents and oceans over long periods of time.				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
1 week (4 hours)	**Biodiversity and classification**	Enormous biodiversity (large variety of species, different ecosystems, genetic differences) on Earth at present. Emphasise the extent of biodiversity and endemism in southern Africa: indigenous and endemic species.		Textbook Photographs Micrographs
		• **Classification schemes**: a way of organising biodiversity. – Brief history of classification: Scientists attempt to classify organisms based on shared features. As information increases classification changes. One of the currently accepted classification systems is the Five-kingdom system; Animalia, Plantae, Fungi, Protista and Monera (Bacteria)	Principles of classification. Grouping everyday objects on the basis of shared similarities. A simple nested hierarchy.	Selection of everyday objects Identification guides Keys
		– Naming things in science: species concept and binomial system. Linnaeus (Carl von Linne) and his role in classification systems: why do we use Latin?		
		– Differences between prokaryotes and eukaryotes *(link to cell structure).*	Classify a selection of familiar organisms into groups based on visible evidence. Use keys and identification guides.	Identification guides Keys Photographs
		• Main groupings of living organisms are bacteria, protists, fungi, plants and animals. Diagnostic features of each of the following: – Bacteria – Protists		

		– Fungi – Plants – Animals		

5 weeks (20 hours)	**History of Life on Earth**	• **Life's history:** Different representations of the history of life on earth. The relationship to changes in climate (e.g. increase in oxygen levels, ice ages) and geological events (e.g. movement of continents; introduction to biogeography); bivalves and ammonites on the Makhatini flats in northern KZN, whale fossils in the Sahara, trilobites in the Karoo. The three eras: Paleozoic, Mesozoic and Coenozoic. Each era divided into periods *(Names of periods not to be memorised)* • **Geological timescale:** Meaning and use of timescales *(details not to be memorised)* • **Cambrian explosion:** Origins of early forms of all animal groups. Life-forms have gradually changed to become present life-forms. • In the last four million years significant changes have occurred in species occurring in Africa (e.g. humans) *(Link with Grade 12)* • **Mass extinctions**: There have been five, two of which are particularly important: 250 mya (resulted in the extinction of about 90% of all life on Earth) and 65 mya (resulted in the extinction of many species, including the dinosaurs).	Construct a timeline showing the history of life on Earth. The timeline should show all the key events from the emergence of the earliest life forms to the present day to emphasise the long history of life. Research the "missing link" between dinosaurs and birds (*Archaeopteryx)* Research the "link" between fish and amphibians (Coelacanth). Present a verbal or written report. Various hypotheses have been proposed for the extinction, 65 million years ago, such as the meteorite impact theory and the vulcanism (in India) theory.	

Total: 6weeks (24 hours)		The rate of extinction on the Earth at present is higher than at any time in the past. The present time has been called the sixth extinction. (*Links to Grades 11 and 12)* • **Fossil formation and methods of dating** e.g. radiometric dating and relative dating. • **Key events** in life's history for which there is evidence from southern Africa. – Origins of the earliest forms of life: evidence of single-celled fossilised bacteria (stromatolites) from many parts of South Africa. – Soft-bodied animals in Namibia, Northern Cape – Early land plants in the Grahamstown area – Forests of primitive plants such as *Glossopteris* near Mooi River and Estcourt. – Location of coal deposits in South Africa (map only) – The Coelacanth as a "living fossil" of the group that is ancestral to amphibians (Northern KZN coast) – Mammal-like reptiles in the Karoo (e.g. *Lystrosaurus* and *Thrinaxodon* – Dinosaurs (Drakensberg and Maluti mountains) (*Euskylosaurus* from Ladybrand in the Free State) and cone-bearing plants – First mammals (Eastern Cape and Lesotho) – Humans and prehumans (Gauteng, North West, Free State, KwaZulu-Natal, Limpopo) Scientists use deductive reasoning (inference) to understand fossils and the history of life on Earth. • The impact of humans on biodiversity and the natural environment.	Select ONE of these hypotheses and describe the evidence scientists have gathered in support of it. (*Nature of science)* Examine fossils at a museum or fossil site or look at photographs of fossils. Optional: Use plaster of Paris to construct a "fossil". Map the Key Event locations on a map of South Africa	

		• Fossil tourism: source of income and employment in some fossil localities.		
ASSESSMENT		1 formal recorded class test. 1 project/assignment. End of year examination (2x 2½ hours). Assessment for learning (informal) using a variety of strategies and appropriate forms of assessment in exercises, summaries, essays, tests, etc. Refer to range of skills specified in Specific Aims1 and 3. Note that knowledge and understanding of investigations and practical work should also be assessed in written worksheets, reports, homework exercises and tests. The cognitive skills listed under Specific Aims 1 and 3 will also apply to knowledge and understanding of investigations.	**Practical examination(1 hour)** Note: The practical work done during the year must develop the range of skills described in Specific Aim 2. The practical examination will assess some of these skills.	

GRADE 11: CONTENT

GRADE 11: LIFE SCIENCES				
TERM 1				
STRAND 1: DIVERSITY, CHANGE AND CONTINUITY Life exists in a wide variety of forms which live in a variety of niches. This section enables learners to be exposed to an array of life forms from microorganisms to macroscopic plants and animals. These are organised according to a man-made system of classification based on observable features. The roles of organisms in an ecosystem are explored including microorganisms being a major cause of diseases. This strand also includes some evolutionary development in plant and animal phyla.				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
3 weeks (12 hours)	**Biodiversity and classification of micro-organisms**	**Biodiversity** • Microorganisms: basic structure and general characteristics of the following groups *(links with Grade 9 and 10)* – viruses – bacteria – protista – fungi (Macroscopic organisms in the protista and fungi should only be mentioned- not studied in any detail) • Mention of the roles in maintaining balance in the environment and web of life: • Symbiotic relationships: nitrogen fixing bacteria in plants, *E.Coli* in human intestine *(link with Grade 10)* • Effect and management of **one** disease from each of the four groups: – viruses (rabies, HIV/AIDS, influenza) – bacteria (blight, cholera, tuberculosis, anthrax)	• Where possible, the prevalence of bacteria/fungi should be demonstrated by growing cultures on agar plates, or bread mould (fungus) on bread. Look for evidence of bacterial/ fungal diseases on plants (school and home)	Textbook Reference books Charts Agar Petri dishes Handlenses

		– protists (malaria) – fungi (rusts, thrush, ringworm, athletes foot) • Immunity: immune response of plants and animals against the infecting micro-organism; vaccinations (briefly) • Use of drugs, e.g antibiotics; effect on micro-organisms • Use of micro-organisms to produce medicines (eg insulin, antibiotics) • Traditional technology to produce eg beer, wine, cheese		
3 weeks (12 hours)	**Biodiversity of plants. (Focus on the developmental lines and not on in-depth studies of life cycles. Learners must be able to use and interpret phylogenetic trees and cladograms)** **Reproduction in plants**	• Grouping of Bryophytes, Pteridophytes, Gymnosperms and Angiosperms according to the presence/absence of – vascular tissue (xylem and phloem) – true leaves and roots – seeds or spores – fruit Decreasing dependence on water for reproduction from Bryophytes to Angiosperms. • **Asexual and sexual reproduction:** advantages and disadvantages of each. • **Flowers as reproductive structures:** adaptations of flowers for pollination; (**different** pollinators) wind, an insect, bird (South African examples **only);** differences	Observe and draw relevant macroscpic parts to provide examples of each of the following divisions: – bryophytes: moss plant – pteridophytes: rhizome, frond with sori – gymnosperms: needles, cones and seeds – angiosperms: flower, fruit and seeds Draw up a phylogenetic tree showing the evolutionary history of the 4 plant groups and major structural changes in their history of development. Dissect an example of each of the	Text book Plant specimens Identification guides/ keys Hand lens Micrographs Charts Models Hand lens Microscope Prepared slides or micrographs Various flowers scalpel or blade hand lens Micrographs

		and similarities. • **Significance of seeds** – seed banks – seeds as food source – endemic species in South Africa	following types of flowers: • wind pollinated • insect pollinated • bird pollinated Record observations as a comparative table. Optional: Germinate seeds: record process	Seeds
2 weeks (8 hours) **Total 8 weeks (32 hours)**	**Biodiversity of animals: Invertebrates. (Focus on developmental lines and phylogenetic trees. No further details regarding the morphology of the six phyla are required).**	• Relationship between body plan and grouping of animals in phyla. Concept of a phylum. • Six phyla (out of about 30 in the animal kingdom): – Porifera – Cnidaria – Platyhelminthes – Annelida – Arthropoda – Chordata • Key features in respect of body plans: – symmetry and cephalisation – number of tissue layers developed from embryo – number of openings in the gut – coelom and blood systems Relationship between body plans and modes of living for each of the six phyla: similarities and differences • Role of invertebrates in agriculture and ecosystems (eg pollination, decomposition, soil aeration etc)	• Calculate approximate surface area: volume ratios of selected examples. • Observe examples from as many phyla as possible (photographs/DVD's). • Select one phylum and design a poster to show diversity in that phylum in South Africa. • Construct a comparative table of these four key features in these six phyla.	Textbook Reference books DVDs Photographs DVDs if possible.

ASSESSMENT	1 formal recorded class test. Assessment for learning (informal) using a variety of strategies and appropriate forms of assessment in tests, homework exercises, worksheets, reports, summaries, essays, etc. Refer to the range of skills listed under Specific Aims 1 and 3. Note that knowledge and understanding to investigations and practical work should also be assessed in written worksheets, reports, homework exercises and tests. The cognitive skills listed under Specific Aims 1 and 3 will also apply to knowledge and understanding of investigations.	1 practical task. Refer to range of skills specified under Specific Aim 2 .

TERM 2				
STRAND 2: LIFE PROCESSES IN PLANTS AND ANIMALS Organisms require energy to stay alive. They get this in one of two ways: by harnessing radiant energy from the sun and transforming it into chemical energy which they can use (autotrophs) or, if they cannot do this themselves, by eating other organisms (heterotrophs). The energy transformations that sustain life (photosynthesis, where energy is incorporated in food), followed by animal nutrition where the food is processed so it can get to the cells, followed by making this energy available to organisms in order to stay alive (cellular respiration). Gas exchange between an organism and its environment is necessary for photosynthesis and cellular respiration to take place. This also involves the removal of carbon dioxide and later in the kidney, to remove nitrogenous wastes from the body.				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
3 weeks (12 hours)	**Energy transformations to sustain life**	• **Photosynthesis** – Process of photosynthesis using words and symbols: intake of raw materials, trapping and storing of energy, formation of food in chloroplasts and its storage. Release of oxygen. Mention only of light and dark phases *(No biochemical detail of light and dark phases required.)* – Importance of photosynthesis: release of oxygen, uptake of carbon dioxide from atmosphere, food production (trapping energy). – The effects of variable amounts of light, carbon dioxide and temperature on the rate of photosynthesis (brief discussion together with graphs) The role of carbon dioxide enrichment, optimum light and optimum temperatures in greenhouse systems to improve crop yields. *(Link to environmental issues discussed later.)* • Role of ATP as an important energy carrier in the cell	**Essential** • Investigate photosynthesis by showing that – starch is produced during photosynthesis – light is necessary for photosynthesis • *The following investigations can be done (by learners) as experiments or as demonstrations:* – carbon dioxide is necessary for photosynthesis – chlorophyll is necessary for photosynthesis. – oxygen is produced during photosynthesis. or – data can be provided and	Textbook Living plants Suitable equipment Chemicals

			interpreted by learners.	
3 weeks (16 hours)	**Animal nutrition (mammals)**	• Differences in respect of dentition for herbivorous, carnivorous and omnivorous lifestyles in terms of nutritional requirements and energy relationships. *(link with ecology - food chains.)* • **Human nutrition:** Identification of the macro-structure of the alimentary canal and associated organs and the functions of the different parts. • **Processes** of ingestion, digestion, absorption, assimilation and egestion and the significance of each. – **Mechanical or physical digestion:** types and functions of different kinds of teeth, processes of chewing. Peristalsis. – **Chemical digestion: Enzymes*:*** functions of carbohydrases, proteases and lipases: where produced; substrate, pH and end-products *(Specific enzymes need not be named – link to enzyme activity.)* – ***Absorption:*** small intestine as a region of most absorption of digested food; adaptations to increase surface area. Structure (to tissue level) and significance of villi. Importance of hepatic portal system in the transport of absorbed food to the liver and then through hepatic vein to the rest of the body. – ***Assimilation:*** incorporation of glucose and amino acids into cells, role of the liver: glucose metabolism, deamination of excess amino acids, and the breakdown of alcohol, drugs and hormones.	Obtain intestines of a sheep from a butcher and trace the passage food will take. Cut open the stomach, portion of the small intestine and portion of the large intestine to compare the structure of the wall in each.	Textbook Newspapers Popular magazines Sheep intestines obtained form a butchery. Scalpel or Sharp knife Hand lenses DVD/Video to show dissection of a mammal in progress

		• **Homeostatic control: Hormonal control** of blood sugar level. Increase of people affected by diabetes in recent years. Brief explanation of diabetes. • The relationships between food intake, energy, growth and health requirements. Balanced diet and changing requirements with age, gender and activity levels: – Different diets: cultural, religious, personal and health choices in respect of diet, e.g. vegan, vegetarian, halaal, kosher. – Interpretation of dietary information on food packaging. – Dietary supplements: for health, sport, beauty, anti-ageing *(link to organic and inorganic substances).* – Malnutrition: reason for and the effects of malnutrition with respect to unbalanced diets (e.g. kwashiorkor), starvation (e.g. marasmus and anorexia), bulimia, food allergies, coronary heart disease, diabetes and obesity. Analysis of information in the popular press, or any other sources, with respect to malnutrition. • Tooth decay related to diet. Fluoride in water supplies and its effect on teeth. • Effects of alcohol and drug abuse and the dangers associated with their misuse.	Calculate the nutritional value of a meal/diet. Use dietary information or food packaging.	Selection of food packaging Photographs of effects of kwashiorkor, marasmus, anorexia, obesity
1½ weeks (6 hours)	**Energy transformations to sustain life**.	• **Cellular respiration** The process of respiration and uses of energy for living cells. – **Aerobic respiration:** in cytoplasm and mitochondria. Use words and symbols: Glycolysis, Krebs cycle and oxidative phosphorylation. *(No biochemical detail is required)*	• Design an investigation or demonstration to show that: – oxygen is used by living organisms during respiration. – carbon dioxide is produced by living organisms during respiration	Textbook Snails or seedlings Chemicals Appropriate equipment

Total **7½ weeks** **(34 hours)**		– **Anaerobic respiration:** production of lactic acid in muscles during exercise; words and symbols *(No biochemical detail of process is required).* • Role of anaerobic respiration in industry - brewing and bread-making **Comparison** between aerobic respiration and anaerobic respiration in terms of raw materials required, products and relative amounts of energy released.	or – provide relevant data that can be interpreted by learners. Identify variables suggest controls for variables. Record observations	
ASSESSMENT		1 formal recorded class test. Midyear examination (2½ hours) Assessment for learning (informal) using a variety of strategies and appropriate forms of assessment in tests, homework exercises, worksheets, reports, summaries, essays, etc. Refer to the range of skills listed under Specific Aims 1 and 3. Note that knowledge and understanding to investigations and practical work should also be assessed in written worksheets, reports, homework exercises and tests. The cognitive skills listed under Specific Aims 1 and 3 will also apply to knowledge and understanding of investigations.	1 practical task. Refer to range of skills specified under Specific Aim 2.	

TERM 3				
STRAND 2: LIFE PROCESSES IN PLANTS AND ANIMALS (Continued)				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
2 ½ weeks (10 hours)	**Gaseous Exchange**	Distinguish between cellular respiration, breathing and gas exchange. Need for gas exchange • **Requirements of efficient gas exchange organs:** - large surface area, - thin - moist - well ventilated - protected - transport system. These requirements are met in different ways in different environments e.g. aquatic and terrestrial animals and in plants. Brief mention of how these requirements are met in: - dicotyledonous plant - earthworm - insect - bony fish - mammal • **Human Gas Exchange:** The structure (macro and tissue level), location, adaptations and functioning of the ventilation system: - trachea - epiglottis - bronchi - bronchioles - lungs	Use books end on end and one on top of another, to illustrate and calculate the differences in respect of surface area to volume ratio which is caused by different shapes: eg. flatworm (Planaria) and an earthworm. Observe and investigate the structure of lungs, associated diaphragm pulmonary blood vessels and heart of a pig or a sheep obtained from a butcher.	Textbooks Models Charts Dissection board and instruments DVD's/Videos Hand lenses

		- ribs - intercostal muscles - diaphragm - alveoli. - Ventilation of the lungs - Gaseous exchange in alveoli - Transport of gases around the body - Gaseous exchange in tissues - Composition of inspired air vs. expired air- analyse data. Brief mention of homeostatic control of breathing. • Diseases and abnormalities: causes symptoms and treatment of TB in South Africa. Brief study of other respiratory diseases: - Asthma - hay fever - Bronchitis - emphysema - lung cancer The effects of smoking on gaseous exchange. Smoking legislation in South Africa. • Mention only of artificial respiration and effect of mouth to mouth resuscitation. • Effects of altitude on gaseous exchange, e.g. performance	Construct a model of the human breathing system. Explain limitations of the model. Demonstrate that expired air contains carbon dioxide. Measure and compare depth of breathing of two or more learners and the effect of exercise on breathing/pulse rate. Interpret data on depth and rate of breathing. Analyse and interpret data showing the effects of altitude on number of red blood cells and	

		of athletes in Johannesburg versus Durban or Cape Town.	consequent effect on athletes at different altitudes.	
2 ½ weeks (10 hours)	**Excretion in humans**	• Excretion in various organs: brief role of each of the following: – lungs – kidneys and bladder – liver – alimentary canal (gut) – skin Substances excreted by each and origins of these substances. • Structure of – urinary system: position of kidneys, ureters, bladder, urethra. – kidney: structure and functioning, removal of urea and excess water and salts, re-absorption of glucose and some salts. – nephron: structure and functioning; ultra-filtration, re-absorption, tubular excretion, pH control, formation of urine • Homeostatic control of water and salts: role of ADH and aldosterone: Dialysis and kidney transplants. • Mention of diseases affecting kidney function, e.g. kidney stones, kidney failure due to overuse of some painkillers, effect of bilharzia infection.	Dissection of sheep or pig kidney (obtained from butchery) with a work sheet to identify the following: capsule, cortex, medulla, pyramids, blood vessels, pelvis, ureter, hilum. Draw and label the dissected kidney	Textbook Charts Model Handlenses Sheep or pig kidney (from butchery) Scalpel/blade Dissecting board Scissors Note: Pig's kidney more closely resembles that if humans.

STRAND 3: ENVIRONMENTAL STUDIES

Organisms interact with other organisms and with the environments in which they live. This section is structured in such a way that learners must explore the impact of people on their environments (global, international and local). Learners are encouraged to look for, and suggest, solutions to local environmental problems. The intention is that the behaviour of the learners will be modified to become more sensitive to environmental issues.

TIME	TOPIC	CONTENT	INVESTIGATIONS	RESOURCES
4 weeks (24 hours)	**Population Ecology**	• **Population size:** Immigration, emigration, mortality, births; fluctuations. Limiting factors, carrying capacity. Logistic and Geometric growth curves with phases. • **Interactions in the Environment** – **Predation:** Two South African examples of predator-prey relationships: graphs. – **Competition:** – **Interspecific**: for light, space, water, shelter, food. – **Intraspecific**: for food, access to mates, water, space, shelter. Survival determined by access to the above- ecological niches. – **Specialisation;** Competitive exclusion and resource partitioning: One example of coexistence in animals, one example in plants. – **Parasitism:** Two examples from Southern Africa. – **Mutualism:** Two examples from South Africa: both species benefit. – **Commensalism:** Two examples from South Africa: one species benefits. • **Social organisation(mention only):** Benefits of herds/flocks (avoidance); packs (hunting) dominance; division of tasks (castes)	Determine size of population by quadrant or simple sampling eg. simulated mark/recapture. Collect and record data. Interpret data. Calculate/estimate population size **Case study**: Rationale for culling e.g. elephants in Kruger National Park as an example of an application of estimating population size (link to **researched** reasons for culling) Draw up public survey form to test public opinion about culling. Show results in a pie graph. Draw a life cycle of bilharzia parasite or tapeworm (Simplify larval stages) Identify area in or close to school grounds where succession is/has	Textbook Reference books Posters, Charts, Brochures DVD's Newspapers Magazines Watching nature programmes on TV

Total **9½ weeks** **(38 hours)**		• **Community change over time: Succession:** primary and secondary succession; possible endpoints depending on environmental fluctuations.(mention only) • **Human Population:** Reasons for exponential growth. - Age and gender distributions for different countries, including South Africa. - Forecast of South Africa's population growth over the next twenty years; possible consequences for the environment.	taken place. (e.g. in the goal area on the sports field at the end of a season or a roadside that has been scraped).	
ASSESSMENT		1 formal recorded class test. Assessment for learning (informal) using a variety of strategies and appropriate forms of assessment in tests, homework exercises, worksheets, reports, summaries, essays, etc. Refer to the range of skills listed under Specific Aims 1 and 3. Note that knowledge and understanding to investigations and practical work should also be assessed in written worksheets, reports, homework exercises and tests. The cognitive skills listed under Specific Aims 1 and 3 will also apply to knowledge and understanding of investigations.	1 practical task, Refer to the range of skills specified in Specific Aim 1.	

TERM 4				
STRAND 3 ENVIRONMENTAL STUDIES (continued) **NOTE: Human Impact on the Environment must be completed in Grade 11 but this topic will be examined in both Grade 11 the National Senior Certificate at the end of Grade 12. In this knowledge Strand it is important to emphasise the interrelatedness and interdependence of the Human Impacts and the environment**				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
7 weeks **(28 hours)**	**Human impact on the environment :Current crises for Human survival: problems to be solved within the next generation**	Causes and consequences of the following (relate to conditions and circumstances in South Africa): • **The atmosphere and Climate change** - Carbon dioxide emissions - Concept of "carbon footprint": need to reduce carbon footprint. - Deforestation - Greenhouse effect and global warming: desertification, drought and floods. - Methane emissions - Ozone depletion • **Water:** two issues: – Availability - Construction of dams - Destruction of wetlands - Poor farming practices - Droughts and floods - Exotic plantations and depletion of water table - Boreholes and effects on aquafers - Wastage	Practical observation of ONE example of human influence on the environment in the **local area** (e.g.impact of alien species on biodiversity). Written report on the chosen example.	Textbook Reference books Reports in the media Share- Net booklets

		- Cost of water – Quality: - Use of water for domestic use, industry, agriculture and mining: pollution. Diseases, eutrophication and algal bloom. - Effect of mining on quality of water - Thermal pollution - Need for water purification and recycling - Alien plants eg. Eichornia. • **Food security** *(link with population dynamics)* – Human exponential population growth – Droughts and floods (climate change) – Poor farming practices: monoculture, pest control, loss of topsoil and the need for fertilisers – Alien plants and reduction of agricultural land. – Loss of wild varieties: impact on gene pools. – Genetically engineered foods – Wastage • **Loss of biodiversity** (the sixth extinction) – Habitat destruction: farming methods eg	Rhino poaching in South Africa-Read articles and make suggestions on how it can be prevented.	

Total		overgrazing and monoculture, golf estates, mining, urbanisation, deforestation; loss of wetlands and grasslands; – Poaching eg. for rhino horn, ivory, "bush meat". – Alien plant invasion: control by mechanical, chemical, biological methods. – Indigenous knowledge systems and sustainable use of the environment eg. Devils' claw, rooibos, fynbos, African Potato (Hypoxis), Hoodia • **Solid Waste disposal** – Managing dumpsites for rehabilitation and prevention of soil and water pollution. – Need for recycling – Methane from dumpsites for domestic use: heating and lighting. – Disposal of nuclear waste.	Analyse solid waste generated in the household in one week: paper, metals, plastic. Estimate the percentage that could be recycled or reused. Visit a municipal landfill site, or local refuse dump, observe rehabilitation (or lack thereof) in practice. Assess the effectiveness of waste management.	

7 weeks **(28 hours)**				
ASSESSMENT	1 formal recorded class test. 1 project/assignment. End of year examination: 2 x 2 ½ hours. Assessment for learning (informal) using a variety of strategies and appropriate forms of assessment in tests, homework exercises, worksheets, reports, summaries, essays, etc. Refer to the range of skills listed under Specific Aims 1 and 3. Note that knowledge and understanding to investigations and practical work should also be assessed in written worksheets, reports, homework exercises and tests. The cognitive skills listed under Specific Aims 1 and 3 will also apply to knowledge and understanding of investigations.		1 practical exam (1 hour) Note: Refer to the range of skills specified in Specific Aim 2.	

GRADE 12: CONTENT

GRADE 12: LIFE SCIENCES				
TERM 1				
STRAND 1: LIFE AT MOLECULAR, CELLULAR AND TISSUE LEVEL All living organisms are made of atoms which combine to form molecules. Of these, DNA, (or Deoxyribonucleic Acid) carries the genetic code for cell specialisation and cell functioning and, together, the genes determine what an organism will look like and how it will function. Plant and animal cells have a complex organisation which enables them to carry out the basic processes of life, i.e. movement, nutrition, respiration, excretion, growth, reproduction and responding to stimuli. Cells are specialised and form tissues which perform particular functions. Tissues are arranged in organs which are also specialised to carry out particular functions**.** In order to understand species, speciation, biodiversity and change, it is essential to understand how DNA and chromosomes enable continuity.				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
2 ½weeks (10 hours)	**DNA: the code of life**	**Deoxyribonucleic Acid (DNA):** – Location in cell; chromosomes, genes and extranuclear DNA. – Brief discussion on discovery of structure of DNA : Watson, Crick, Franklin and Wilkins – Structure of DNA – Role of DNA: genes and non-coding DNA – Replication: cell cycle *(link to Grade 10):* necessity for exact copy. **Ribonucleic Acid (RNA):** – Types, location in cells – Structure of RNA – Transcription from DNA – Translation of RNA into proteins (protein synthesis) (mRNA, tRNA): sequence of events	If possible: • simple process to extract DNA and examine the threads If possible: • DNA “finger printing” /DNA profiling: (case study only)	Textbook Micrographs Equipment Chemicals

		– Genetic code (basic understanding)		
2 weeks (8 hours)	**Meiosis**	• **Meiosis:** the process of reduction division – purposes of reduction division (gametogenesis and exceptions: mosses, ferns) – Importance of meiosis: diploid to haploid: production of gametes – Introducing genetic variation (random segregation, crossing over) – Consequences of abnormal meiosis, e.g. Down's syndrome • Mitosis and meiosis: similarities and differences *(link to Grade 10)*	Observe and draw prepared microscope slides or micrographs or models of cells in selected stages of meiotic cell division. e.g. crossing over in metaphase I; anaphase I, metaphase II, telophase II	Textbook Posters Models Microscope Prepared microscope slides or micrographs

STRAND 2: LIFE PROCESSES IN PLANT AND ANIMALS. This knowledge strand deals with the way animals are able to respond to their environments in order to ensure survival and learners explore different reproductive strategies in animals. Reproduction in humans is dealt with in more detail as a specific example of animal reproduction. This expands on the basic knowledge of human reproduction that was introduced in Grades 7 and 9.

TIME	TOPIC	CONTENT	INVESTIGATIONS	RESOURCES
½ week (2 hours)	**Reproduction in Vertebrates**	• **Diversity of reproductive strategies** Appropriate examples of different groups in the animal kingdom to illustrate maximising reproductive success in different environments: – external or internal fertilisation		Textbook Charts Reference books DVDs (if possible)

		– ovipary, ovovivipary, vivipary – amniotic egg – precocial and altricial development – parental care		
3 weeks (12 hours) **Total 8 weeks (32 hours)**	**Human reproduction**	• Structure of male and female reproductive systems; (*link to Grade 7 and 9)* • Unique human characteristics of some aspects of reproduction (*link with Grade 9)*: – puberty: main changes – gametogenesis: relate briefly to meiosis (no individual names of stages) – menstrual cycle: emphasis on hormonal control – fertilisation and development of zygote to blastocyst – gestation: brief mention – implantation and development: role of placenta	Prepared microscope slides of ovary and testes. Section through penis. Identify tissues and different structures. Observe and describe prepared microscope slides or micrographs or ultrasound pictures of embryonic development. Observe stages of pregnancy DVD's of development of embryo and birth process. Observe contraceptive devices	Textbook Charts micrographs microscope prepared microscope slides Ultrasound pictures of embryonic development DVD's
ASSESSMENT		1 formal, recorded class test. Assessment for learning (informal) using a variety of strategies and appropriate forms of assessment in homework exercises, written worksheets, reports, summaries, essays, tests , etc. Refer to range of skills specified in Specific Aims 1 and 3. Note that knowledge and understanding of investigations and practical work should also be assessed in written worksheets, homework exercises and tests. The cognitive skills listed under Specific Aims 1 and 3 will also apply to knowledge and understanding of investigations.	1 practical task Refer to the range of skills specified in Specific aim 2.	

TERM 2				
STRAND 1: LIFE AT MOLECULAR, CELLULAR AND TISSUE LEVEL (continued) **and STRAND 4: DIVERSITY, CHANGE AND CONTINUITY.** Life exists in a variety of life forms and it is in the study of DNA, genetics and inherited characteristics that life at molecular level intersects with STRAND 4: Diversity, Change and Continuity**.** In order to understand species, speciation, biodiversity and change, it is essential to understand how DNA and chromosomes enable continuity.				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
4 weeks (16 hours)	**Genetics and inheritance**	• **Genes**: dominant, recessive, alleles Mention of Mendel, father of genetics • **Inheritance and variation in:** – **Monohybrid crosses:** phenotype and genotype, homozygous and heterozygous (pure bred and hybrid); examples of complete, incomplete/partial dominance and codominance. – **Dihybrid crosses**: phenotypes and genotypes • **Sex chromosomes**; sex-linked alleles; sex-linked diseases • **Mutations:** – Harmless, harmful: examples of diseases, disorders; gene mutations and chromosomal aberrations – Useful mutations, link with natural selection • Genetic engineering: stem cell research, genetically modified organisms, biotechnology, cloning • Mention of Mitochondrial DNA: tracing genetic links • Paternity testing, DNA finger printing (forensics)	**Solving genetic problems** • Monohybrid crosses • Dihybrid crosses • Complete and incomplete dominance • Blood groups • Sex chromosomes and sexually linked diseases eg. haemophilia and colour blindness • Genetic lineages	Textbook Reference books

STRAND 2: LIFE PROCESSES IN PLANTS AND ANIMALS (continued) This continues with the way in which animals and plants are able to respond to their environments in order to ensure their survival.				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
4 weeks (16 hours)	**Responding to the environment: humans**	• **Humans have two systems: nerves** and **hormones** enable them to respond to the environment. • **Human nervous system:** reaction to stimuli in surroundings – **Central nervous system**: Brain Meninges for protection, location and functions of cerebrum, cerebellum, corpus callosum, medulla oblongata, spinal cord – **Peripheral nervous system:** location and functions only – **Autonomic nervous system:** location and functions only – **Nerves: Structure of a nerve :** Nerve tissue: structure of sensory neurons and motor neurons – **Reflex arc:** Structure, function and significance of a simple	• Model of brain or sheep brain in order to observe regions of brain. Identify cerebrum, cerebellum, spinal cord • Cross section of spinal cord to observe the white and grey matter. • Design an investigation to determine the reaction time of different learners to a	Textbook Wall charts Sheep eye for dissection Scalpel or blade Models: eye ear brain • Sheep's skull sawn in half to expose the brain (obtained from the butchery) • Obtain sawn through vertebrae from butcher to show spinal cord.

Total **8 weeks** **(32 hours)**		reflex arc. Significance of synapses. • **Disorders:** Alzheimer's, Multiple sclerosis • **Injuries:** brain and spinal damage. Mention of stem cell research and the possibility of repairing injuries • **Effects of drugs:** dagga, heroin, ecstasy, tik. • **Receptors:** Detection of a range of stimuli: light, sound, touch, temperature, pressure, pain and chemicals (taste and smell):details of structure of eye and ear only. – **Human eye**: structure and functioning, binocular vision, accommodation, pupil reflex. – Short-sightedness, long-sightedness, astigmatism, cataracts (brief explanations using diagrams) – **Human ear**: structure and functioning: hearing and balance. – Hearing defects: deafness, middle ear infections, grommets	stimulus. Record the results and calculate the average time. Calculate the distance that will be travelled by a car travelling at 100 km per hour within the average reaction time. Apply this knowledge to safe driving: following distances Dissection of eye of sheep or pig. Observe regions. Worksheet to be used to follow instructions in the dissecting and observation of significant parts.	Eye of sheep or pig obtained from butchery
ASSESSMENT		1 formal, recorded class test. Midyear examination (2½ hours) or control test (see page 30) Assessment for learning (informal) using a variety of strategies and appropriate forms of assessment in homework exercises, flow diagrams, written worksheets, reports, summaries, essays, tests, etc. Refer to range of skills specified in Specific Aims 1 and 3. Note that knowledge and understanding of investigations and practical work should also be assessed in written worksheets, homework exercises reports, essays etc. The cognitive skills listed under Specific Aims 1 and 3 will also apply to knowledge and understanding of investigations.	1 Practical task. Refer to the range of skills specified in Specific Aim 2	

TERM 3				
STRAND 2:LIFE PROCESSES IN PLANTS AND ANIMALS (continued) This continues with the way in which animals and plants are able to respond to their environments in order to ensure their survival.				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
1½ weeks (6 hours)	**Human endocrine system**	• **Endocrine glands:** Location in the body, hormones secreted, role of hormones of the following glands: – Hypothalamus : ADH – Pituitary gland : TSH, FSH,LH, prolactin, growth hormone (*link to reproduction)* – Thyroid gland: thyroxin – Pancreas: insulin, glucagon; diabetes – Adrenal gland: adrenalin, aldosterone – Gonads: oestrogen, progesterone and testosterone (*link to reproduction)* Examples of negative feedback mechanisms: TSH and thyroxin; insulin and glucagon.	• Research disorders caused by under-and over secretion of at least one hormone. Different learners should research different hormones. Brief written report.	Textbook Charts Photographs of giantism, dwarfism Persons suffering from: hypothyroidism hyperthyroidism
1 week (4 hours)	**Homeostasis in humans**	• **Homeostasis:** maintaining constant, optimal internal environment – **Negative feedback:** glucose, carbon dioxide; water and salts – **Thermoregulation:** adaptations of human skin; sweating, vasodilatation, vasoconstriction	Observe prepared microscope slide of section through human skin or use micrograph or model. Identify main features.	Textbook Microscope prepared slides or Micrographs or model

1 week (4 hours)	**Responding to the environment: plants**	• **Plant hormones**: general functions of auxins, gibberellins, abscisic acid. Weed control by using growth hormones • **Geotropism and phototropism**: growth regulation by auxins • **Plant defence mechanisms**: chemicals, thorns	Design investigations to show geotropism and phototropism. Identify the variables and recommend ways to control the variables. Record the results and interpret the results.	Textbook Suitable equipment: geotropism and phototropism experiments. If available, klinostat should be used. Seedlings
STRAND 4 : DIVERSITY, CHANGE AND CONTINUITY (continued): The work done earlier in the year, on DNA, genetics and heredity, is necessary to understand the concept of change, natural selection and evolution. This knowledge strand is expanded on by exploring the mechanisms of evolution and specifically human evolution in Africa. .				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
2 weeks (8 hours)	**Evolution by natural selection**	• **Origin of ideas about origins:** Different kinds of evidence: fossil record *(link to Grade 10)*, modification by descent, biogeography *(link to Grade 10)*, genetics *(Grade 12)* and other forms of evidence – Difference between hypothesis and theory – Brief overview of history of different theories of development; Lamarckism, Darwinism, Punctuated Equilibrium. • **Darwin's theory of evolution by natural selection** • Evolution (change) through **natural selection** *(link to Genetics)*: depends on variation/gene pool of inherited characteristics, and the production of more offspring than is required: changes in environment, pressure: extinction or successful adaption. Continuous and discontinuous variation. • **Artificial selection:** mimics natural selection; ONE example of a domesticated animal **and** ONE example of a crop	Class debate and discussion Demonstration of natural selection using games, e.g. camouflage Research one example of artificial selection. Present findings in a report.	Textbook Reference books. Biography of Darwin (if possible and if a learner shows interest)

		species. • **Formation/emergence of new species**: Speciation, biological species concept, interbreeding produces viable offspring in a species. ONE example of speciation due to geographic isolation (Galapagos finches, Galapagos tortoises, mammals or plants on different landmasses, e.g. baobabs in Africa and Madagascar, proteas in South Africa and Australia) • **Mechanisms for reproductive isolation:** Introduction to some examples: – breeding at different times of the year – species-specific courtship behaviour – adaptation to different pollinators (plants) – prevention of fertilisation – infertile offspring in cross-species hybrids • **Evolution in present times:** Examples of natural selection and evolution, e.g. resistance to insecticides in insects, bill and body size of Galapagos finches, resistance to antibiotics in various bacteria (TB), HIV resistance to anti-retrovirals		
2 weeks (8 hours)	**Human evolution**	• **Evidence of common ancestors for living hominids including humans:** anatomical differences and similarities between African apes and humans : – fossil evidence: key features: bipedalism (spine and pelvic girdle), brain size, teeth (dentition), prognathism and palate shape, cranial and brow ridges, the number of fossils that have been found. (Important to know that thousands of fossil fragments have been found). – genetic evidence: mitochondrial DNA	**Poster presentation:** Map out the three major phases in hominid evolution from 6 mya to the present: – Ardipithecus(Ethiopia) – Australopithecus (East and South Africa) – Homo (various sites) The map/timeline should show the diagnostic features and the approximate times that examples of the three major	Textbook Newspaper articles (e.g. the discovery of sediba) DVDs if possible Maps, pictures, photographs

Total **7½ weeks** **(30 hours)**		– cultural evidence, tool-making. • **Out of Africa hypothesis:** Evidence of African origins for all modern humans; genetic links, mitochondrial DNA. – Rift valley fossil sites in East Africa (Kenya and Tanzania) and in Ethiopia. Scientists eg. Johansen and White, the Leaky family Fossils discovered at these sites: Ardipithecus, Australopithecus, Homo Fossils sites in South Africa: Fossils discovered at these sites: Australopithecus and Homo	genera existed. If is not necessary to show the relationships between genera. (Scientists may interpret relationships differently as new evidence is found) or (see term 4)	
ASSESSMENT		1 formal, recorded test. Trial examination: 2 x 2 ½ hours. 1 project/assignment. Assessment for learning (informal) using a variety of strategies and appropriate forms of assessment in tests, homework exercise, written worksheets, reports, summaries, essays, etc. Refer to the range skills specified in Specific Aims 1 and 3 Note that knowledge and understanding of investigations and practical work should also be assessed in written worksheets, homework, summaries, reports and essays and tests. The cognitive skills listed under Specific Aims 1 and 3 will also apply to knowledge and understanding of investigations.	1 Practical task. Refer to range of skills specified in Specific Aim 2.	

TERM 4				
STRAND 4 :DIVERSITY, CHANGE AND CONTINUITY				
TIME	**TOPIC**	**CONTENT**	**INVESTIGATIONS**	**RESOURCES**
2 weeks (8 hours) **2 weeks (8 hours)** **Total 4 weeks (16hours)**	**Human evolution continued**	**Importance of the Cradle of Humankind** • **Main fossil sites in South Africa e.g.** Sterkfontein, Kromdraai, Driemolen, Plovers Lake, Gladysvale,Makapansgat, Florisbad, Border Cave. Evidence from these sites. Evolutionary trends. (*Refer to dating of fossils Grade 10)* At least two examples should be studied to see evolutionary trends. Mention of scientists such as Dart, Broome, Tobias, Brain, Ron Clark, Berger, Keyser and others. • **Alternatives to evolution** **-**Creationism **-**Intelligent Design **-**Different cultural and religious explanations for the origin and development of life on earth. **REVISION PARTICULARLY (BUT NOT ONLY) OF GRADE 11 WORK THAT WILL BE EXAMINED IN THE NSC EXAM**	Poster presentation: Map out the changes in the evolution of the Genus: Homo. The map/timeline should show where the different fossils have been found and the approximate periods that the selected examples existed**.** The most significant features of each type of fossil (Genus and species) to illustrate the difference between them. Research and discussion to share information about different explanations: cultural or religious explanations.	
ASSESSMENT: 2 x 2½ hour exams: Paper 1 and Paper 2(topics specified)				

SECTION 4

4. ASSESSMENT

4.1 INTRODUCTION

Assessment is a continuous planned process of identifying, gathering and interpreting information about the performance of learners, using various forms of assessment. It involves four steps: generating and collecting evidence of achievement; evaluating this evidence; recording the findings and using this information to understand and thereby assist the learner's development in order to improve the process of learning and teaching.

Assessment should be both informal (Assessment for Learning) and formal (Assessment of Learning). In both cases regular feedback should be provided to learners to enhance the learning experience.

Assessment is a process that measures individual learners' attainment of knowledge (content, concepts and skills) in a subject by collecting, analysing and interpreting the data and information obtained from this process to:

- enable the teacher to make reliable judgements about a learner's progress
- inform learners about their strengths, weaknesses and progress
- assist teachers, parents and other stakeholders in making decisions about the learning process and the progress of the learners.

Assessment should be mapped against the content and the intended aims specified for Life Sciences and in both informal and formal both assessments it is important to ensure that in the course of a school year:

- all of the subject content is covered
- the full range of skills is included
- a variety of different forms of assessment are used.

4.2 INFORMAL OF DAILY ASSESSMENT

Assessment **for** learning has the purpose of continuously collecting information on a learner's achievement that can be used to improve their learning.

Informal assessment involves a daily monitoring of learners' progress. This is done through observations, discussions, practical demonstrations, learner-teacher conferences, informal classroom interactions, etc. Informal assessment may be as simple as stopping during the lesson to observe learners or to discuss with learners how learning is progressing. Informal assessment should be used to provide feedback to the learners and to inform planning for teaching, but need not be recorded. It should not be seen as separate from learning activities taking place in the classroom. Learners or teachers can mark these assessment tasks.

Self assessment and peer assessment actively involves learners in assessment. In Grade 10, learners should be assisted during the initial stages. This is important as it allows learners to learn from and reflect on their own performance.

The results of the informal daily assessment tasks are not formally recorded unless the teacher wishes to do so. The results of daily assessment tasks are not taken into account for promotion and certification purposes.

Informal, ongoing assessments should be used to structure the acquisition of knowledge and skills and should be precursor to formal tasks in the Programme of Assessment.

4.3 FORMAL ASSESSMENT

Grades	Formal school-based assessments	End-of-year examinations
R-3	100%	n/a
4-6	75%	25%
7-9	40%	60%
10 and 11	25% including a midyear examination	75%
12	25% including midyear and trial examinations	External examination: 75%

All assessment tasks that make up a formal programme of assessment for the year are regarded as Formal Assessment. Formal assessment tasks are marked and formally recorded by the teacher for progression and certification purposes. All Formal Assessment tasks are subject to moderation for the purpose of quality assurance and to ensure that appropriate standards are maintained.

Formal assessment provides teachers with a systematic way of evaluating how well learners are progressing in a grade and in a particular subject. Examples of formal assessments include tests, examinations, practical tasks, projects, oral presentations, demonstrations, performances, etc. Formal assessment tasks form part of a year-long formal Programme of Assessment in each grade and subject.

The cognitive demands in assessment should be **appropriate for the age and developmental level** of the learners in the grade. Assessment in Life Sciences must cater for a range of cognitive levels and abilities of learners. The assessment tasks should be carefully designed to cover the content of the subject as well as the range of skills and the cognitive levels that have been identified in the Specific Aims. The design of assessments should therefore ensure that a full range of content and skills are assessed within the each year. The Specific Aims, topics, content and range of skills in the subject should be used to inform the planning and development of assessments.

WEIGHTING OF COGNITIVE LEVELS FOR THE ASSESSMENT OF CONTENT IN GRADE 10

	Knowing Science	Understanding Science	Applying Scientific Knowledge	Evaluating Analysing Synthesising Scientific Knowledge
%	40%	25%	20%	15%
Useful Verbs	State Name Label List Define Describe and others……	Explain Compare Rearrange Give an example of Illustrate Calculate Make a generation and others…	Predict Apply Use knowledge Demonstrate Solve Implement Judge and others….	Select Differentiate Analyse Infer Suggest a reason Discuss Categorise and others……..

Note: A single, formal class test per term will not necessarily provide the most accurate and reliable evidence of every learner's performance. As far as possible teachers should try to let learners write more than one test per term in order to get a better picture of abilities of learners in the class. One formal class test per term is the minimum number that must be recorded.

The requirements (number and nature of tasks) for Life Sciences are indicated below:

4.4 ASSESSMENT REQUIREMENTS FOR LIFE SCIENCES:

4.4.1 GRADE 10

The programme of Assessment is designed to spread formal assessment tasks in all subjects in a school throughout a term.

<table>
<tr><td colspan="8">PROGRAMME OF FORMAL ASSESSMENT</td></tr>
<tr><td colspan="4">FORMAL, RECORDED, SCHOOL-BASED ASSESSMENTS</td><td colspan="4">END-OF-YEAR INTERNAL EXAMINATION 75%</td></tr>
<tr><td colspan="2">CONTENT</td><td colspan="2">PRACTICAL</td><td colspan="2">2 WRITTEN EXAMINATIONS (2½ HOURS + 2½ HOURS)</td><td colspan="2">PRACTICAL EXAMINATION (1HOUR)</td></tr>
<tr><td colspan="2">• 4 tests (minimum of 50 marks each)
• 1 midyear examination (2½ hours 150 marks)
• 1 project/assignment (can be done in any term: 100 marks in the fourth term)
• Skills are listed under Specific Aims 1 and 3</td><td colspan="2">A selection of 3 representative practical tasks, which cover the range of skills, must be marked and recorded. (The marks allocated for a practical task should range from 20 to 40).
Range of skills described under Specific Aim 2.</td><td colspan="2">Content, concepts, skills across all topics. Knowledge of practical work as well as some of the skills related to practical work must be assessed in the written examination.

80%=60 marks</td><td colspan="2">Practical knowledge and skills This should be set by each teacher taking into account the resources that are available for practical examination.

20%= 15 marks</td></tr>
<tr><td colspan="4">SCHOOL-BASED ASSESSMENT (during the year)</td><td colspan="4">75</td></tr>
<tr><td>TERM 1</td><td>TERM 2</td><td>TERM 3</td><td>TERM 4</td><td colspan="4" rowspan="3">↓</td></tr>
<tr><td>• 1 test
• 1selected practical task</td><td>• 1 test
• 1 selected practical task
• Midyear examination</td><td>• 1 test
• 1 selected practical task
*Environmental studies: fieldwork</td><td>• 1 test
• 1 project/assignment</td></tr>
<tr><td>25%</td><td>25%</td><td>25%</td><td>25%</td></tr>
<tr><td colspan="4">Convert to 25%</td><td colspan="4">75%</td></tr>
</table>

*This is an example of a project/assignment

4.4.2 GRADE 11

PROGRAMME OF FORMAL ASSESSMENT					
FORMAL, RECORDED, SCHOOL-BASED ASSESSMENTS				**END-OF-YEAR INTERNAL EXAMINATION 75%**	
CONTENT		**PRACTICAL**		**2 WRITTEN EXAMINATIONS (2½ HOURS + 2½ HOURS)**	**PRACTICAL EXAMINATION (1HOUR)**
• 4 tests (minimum of 50 marks each) • 1 midyear examination (2½ hours 150 marks) • 1 project/assignment (can be done in any term: 100 marks in term 4) • Skills are listed under Specific Aims 1 and 3		A selection of 3 representative practical tasks, which **cover the range of skills**, must be marked and recorded. (The marks allocated for a practical task should range from 20 to 40). Range of skills described under Specific Aim 2.		Content, concepts, skills across all topics. Knowledge of practical work as well as some of the skills related to practical work must be assessed in the written examination. **80%=60 marks**	Practical knowledge and skills **20%= 15 marks**
SCHOOL-BASED ASSESSMENT (during the year)				**75**	
TERM 1	**TERM 2**	**TERM 3**	**TERM 4**		
• 1 test • 1selected practical task	• 1 test • 1 selected practical task • Midyear examination	• 1 test • 1 selected practical task *Environmental studies: fieldwork	• 1 test • 1 project/assignment		
25%	**25%**	**25%**	**25%**		
Convert to 25%				**75%**	

*This is an example of a project/assignment

4.4.3 GRADE 12

<table>
<tr><td colspan="4">FORMAL, RECORDED, SCHOOL-BASED ASSESSMENTS</td><td>TRIAL: END-OF-YEAR INTERNAL EXAMINATION 50%</td></tr>
<tr><td colspan="2">CONTENT</td><td colspan="2">PRACTICAL</td><td>2 WRITTEN EXAMINATIONS (2½ HOURS + 2 ½ HOURS)</td></tr>
<tr><td colspan="2">• 4 tests (minimum of 50 marks each)
• *1 midyear examination (2½ hours 150 marks)
• 1 trial examination (2 x 2½ hours 300 marks)
• 1 project/assignment (can be done in any term: 100 marks in term 3).
• Skills are listed under Specific Aims 1 and 3</td><td colspan="2">A selection of 3 representative practical tasks, which cover the range of skills, must be marked and recorded. (The marks allocated for a practical task should range from 20 to 40).
Range of skills described under Specific Aim 2.</td><td rowspan="5">Content, concepts, skills across all topics. Knowledge of practical work as well as some of the skills related to practical work must be assessed in the written examination

The trial (preliminary) examination should be set on the work completed in Terms 1,2 and 3.</td></tr>
<tr><td colspan="4">SCHOOL-BASED ASSESSMENT (during the year)</td></tr>
<tr><td>TERM 1</td><td>TERM 2</td><td colspan="2">TERM 3 and TERM 4</td></tr>
<tr><td>• 1 test
• 1selected practical task</td><td>• 1 test
• 1 selected practical task
• *Midyear examination or control test</td><td colspan="2">• 1 test
• 1 selected practical task
• 1 project/assignment
• 1 test (will not be included in year mark)
*Environmental studies: fieldwork</td></tr>
<tr><td>33%</td><td>33%</td><td colspan="2">33%</td><td></td></tr>
<tr><td colspan="4">Convert to 50%</td><td>50%</td></tr>
</table>

*Note: Schools that are performing well (above an 80% pass rate in the previous year) **may** elect not to write the midyear examination.

Note: The year mark will be converted to 25% and the **external** examination will count 75% of the final mark.

4.5 END OF YEAR EXAMINATIONS:

4.5.1 GRADE 10

The examination will consist of 2 examination papers of 2 ½ hours and 150 marks each

The weighting and assessment of topics in Paper 1 and Paper 2 will be as follows:

PAPER 1

TOPIC	**TIME**	**WEIGHTING**	
		%	**MARKS**
T 1 • Chemistry of Life	2½ weeks	**16**	**23**
• Cells: basic units of Life	3 weeks	**17**	**25**
• Cell division: Mitosis	2 weeks	**12**	**18**
• Plant and animal tissues	1 week	**4 (50)**	**9**
T2 • Plant and animal tissues	2 weeks	**13**	**20**
• Plant organs (leaf)	½ week	**3**	**5**
• Support and transport systems: plants	3 weeks	**17**	**25**
• Support systems in animals	3 weeks	**17 (50)**	**25**
TOTALS	**17 weeks**	**100%**	**150**

PAPER 2

TOPIC	TIME	WEIGHTING	
		%	MARKS
T 3 • Transport systems in mammals	3weeks	**20**	**30**
• Biosphere to Ecosystems	5weeks	**40 (60)**	**60**
T4 • Biodiversity and Classification	1 week	**7**	**10**
• History of Life and Earth	5 weeks	**33 (40)**	**50**
TOTALS	**15 weeks**	**100%**	**150**

The weighting per topic must serve as a guideline for teachers and slight deviations in respect of the number of marks allocated to a topic would be acceptable. The purpose of providing the weighting is to ensure that all topics are covered in approximately the correct weighting.

4.5.2 GRADE 11

The examination will consist of 2 examination papers of 2½ hours and 150 marks each. The weighting and assessment of topics in Paper 1 and Paper 2 will be as follows:

PAPER 1

TOPIC	TIME	WEIGHTING	
		%	MARKS
T 2 • Energy transformations to sustain Life: Photosynthesis	3 weeks	**18**	**27**
• Animal Nutrition	3weeks	**18**	**27**
• Energy transformation: Respiration	1½ weeks	**10**	**15**
T3 • Gas exchange	2 ½weeks	**15**	**22**
• Excretion in humans	2½ weeks	**15**	**23**
• Population Ecology	4 weeks	**24**	**36**
TOTALS	**16½weeks**	**100%**	**150**

PAPER 2

TOPIC	TIME	WEIGHTING	
		%	MARKS
T 1 • Biodiversity and classification of micro-organisms	3weeks	**20**	**30**
• Biodiversity in plants + reproduction	3weeks	**20**	**30**
• Biodiversity of Animals	2 weeks	**13**	**20**
T4 • Human impact on the environment: current crises	7 weeks	**47**	**70**
TOTALS	**15 weeks**	**100%**	**150**

The weighting per topic must serve as a guideline for teachers and slight deviations in respect of the number of marks allocated to a topic would be acceptable. The purpose of providing the weighting is to ensure that all topics are covered in approximately the correct weighting.

4.5.3 GRADE 12

The examination will consist of 2 examination papers of 2 ½ hours and 150 marks each. The weighting and assessment of topics in Paper 1 and Paper 2 will be as follows:

PAPER 1

TOPIC	TIME	WEIGHTING	
		%	MARKS
T 1 • Meiosis	1 week	**7**	**11**
• Reproduction in Vertebrates	½ week	**4**	**6**
• Human Reproduction	3 weeks	**21**	**31**
T2 • Responding to be environment (humans)	4 weeks	**27**	**40**
T3 • Human endocrine system	1½ weeks	**10**	**15**
• Homeostasis in humans	1 week	**7**	**11**
• Responding to the Environment (plants)	1 week	**7**	**11**
T4 • Human impact (Grade 11)	"2 ½ weeks"	**17**	**25**
TOTALS	**14 ½weeks**	**100%**	**150**

PAPER 2

TOPIC	TIME	WEIGHTING	
		%	MARKS
T 1 • DNA: Code of Life • Meiosis	2½ weeks 1 week	**19** **7**	**27** **12**
T 2 • Genetics and Inheritance	4 weeks	**30**	**45**
T3 • Evolution by Natural Selection	3 weeks	**15**	**23**
T 3/T4 • Human Evolution	4 weeks	**29**	**43**
TOTALS	**13 ½ weeks**	**100%**	**150**

The weighting per topic must serve only as a guideline to teachers and examiners and is included to ensure that all topics are adequately covered in examinations. It is not expected that the number of marks per topic will be exact in the examination papers.

4.6 RECORDING AND REPORTING

Recording is a process in which the teacher documents the level of a learner's performance in a specific assessment task. It indicates learner progress towards the achievement of the knowledge and skills as prescribed in the Curriculum and Assessment Policy Statement. Records of learner performance should provide evidence of the learner's conceptual progression within a grade and her / his readiness to progress or be promoted to the next grade. Records of learner performance should also be used to verify the progress made by teachers and learners in the teaching and learning process.

Reporting is a process of communicating learner performance to learners, parents, schools, and other stakeholders. Learner performance can be reported in a number of ways. These include report cards, parents' meetings, school visitation days, parent-teacher conferences, phone calls, letters, class or school newsletters, etc. Teachers in all grades report in percentages against the subject. The various achievement levels and their corresponding percentage bands are as shown in the table below.

Note: The seven point scale should have clear descriptions that give detailed information for each level. Teachers will record actual marks against the task by using a record sheet; and report percentages against the subject on the learners' report card.

Codes and percentages for reporting in Grades R-12

RATING CODE	DESCRIPTION OF COMPETENCE	PERCENTAGE
7	Outstanding achievement	80-100
6	Meritorious achievement	70-79
5	Substantial achievement	60-69
4	Adequate achievement	50-59
3	Moderate achievement	40-49
2	Elementary achievement	30-39
1	Not achieved	0-29

Schools are required to provide quarterly feedback to parents on the Programme of Assessment using a formal reporting tool such as a report card. The schedule and the report card should indicate the overall level of performance of a learner.

4.7 MODERATION OF ASSESSMENT

4.7.1 GRADES 10 AND 11

Moderation refers to the process that ensures that the assessment tasks are fair, valid and reliable. Moderation should be implemented at school, and district levels and if necessary also at, provincial levels. Comprehensive and appropriate moderation practices must be in place for the quality assurance of all subject assessments.

In Grades 10 and 11 Formal School Based Assessment and the Practical Assessment tasks should be moderated by the relevant subject specialists at district and, if necessary, provincial levels in consultation with the moderators at the school. Moderation serves five purposes:

- Firstly, it should ascertain whether the subject-specific content and skills are sufficiently covered.
- Secondly, the moderator must ensure that the various levels of cognitive demand are reflected in the assessments.
- Thirdly, that the assessments and marking are of an acceptable standard and consistency.
- Fourthly, to ensure that assessments in different schools are more or less comparable whilst recognising that different teachers have different standards.
- Finally, to identify areas in which the teacher may need further support and development and to provide such, necessary, support.

In Grades 10 and 11 there is no compulsory national moderation. Moderation is therefore an ongoing process and not a once-off, end-of-year event.

4.7.2. GRADE 12

Moderation refers to the process that ensures that the assessment tasks are fair, valid and reliable. Moderation should be implemented at school, district, provincial and **national** levels. Comprehensive and appropriate moderation practices must be in place for the quality assurance of all subject assessments.

4.7.2.1. FORMAL ASSESSMENT (SCHOOL BASED ASSESSMENT – SBA)

In **Grade 12**, moderation must take place at four levels:

- **School based moderation and verification of learner performance**. This is intended to ensure that the assessments meet the requirements in terms of content, cognitive demands and skills; that the marking has been consistent and fair and that the marks are a true reflection of learner performance in the assessments. This will enable the school to identify problems related to the pacing, standard and reliability of assessment easily and to ensure that appropriate interventions are put in place early. This is an ongoing process.
- **Moderation by the subject advisor:** This is also an ongoing process. Subject advisors should moderate assessments, to ascertain whether
  - subject specific content and skills have been covered adequately,
  - the number of assessments have been complied with
  - the appropriate cognitive demands are reflected in the assessments
  - the marking is of an acceptable standard and is consistent
  - the assessments in different schools are comparable whilst recognising that different teachers teach and assess differently.

  Subject advisors should provide teachers with the necessary guidance and support should any shortcomings be identified. Early identification of shortcomings and early interventions are essential. It is therefore necessary that moderation at this level should be ongoing and not a once-off end-of-year event.

- **Moderation by the province:** Moderation of SBA at this level is once-off and is related to the quality assurance processes that are necessary in terms of National Policy developed by the Department of Basic Education and Umalusi jointly.

- **At a national level**: Statistical moderation of learner performance in the School Based Assessment is necessary to ensure comparability across schools, districts, and provinces.

Note that, in Grade 12, the assessment of Practical work is incorporated into the SBA (per term) and that there is no practical examination. This is because schools are not all equally resourced and some learners may be disadvantaged because of this.

4.8 GENERAL

This document should be read in conjunction with:

4.8.1 *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R – 12*; and

4.8.2 The policy document, *National Protocol for Assessment Grades R – 12.*