basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

CURRICULUM AND ASSESSMENT POLICY STATEMENT

(CAPS)

LIFE SCIENCES

FINAL DRAFT

SECTION 1

NATIONAL CURRICULUM AND ASSESSMENT POLICY STATEMENT FOR LIFE SCIENCES

1.1 Background

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

To improve its implementation, the National Curriculum Statement was amended, with the amendments coming into effect in January 2011. A single comprehensive Curriculum and Assessment Policy document was developed for each subject to replace the old Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R - 12.

The amended *National Curriculum Statement Grades R - 12: Curriculum and Assessment Policy (January 2011) replaces the National Curriculum Statement Grades R - 9 (2002) and the National Curriculum Statement Grades 10 - 12 (2004)*.

1.2 Overview

(a) The *National Curriculum Statement Grades R – 12 (January 2011)* represents a policy statement for learning and teaching in South African schools and comprises the following:

  (i) Curriculum and Assessment Policy documents for each approved school subject as listed in the policy document *National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF);* and

  (ii) The policy document *National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF).*

(b) The *National Curriculum Statement Grades R – 12 (January 2011)* should be read in conjunction with the following documents:

  (i) *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 Grade R – 12*, published in the *Government Gazette, No. 29467* of 11 December 2006; and

  (ii) *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 the *Government Gazette, No.29466* of 11 December 2006.

(c) The Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines for Grades R - 9 and Grades 10 - 12 are repealed and replaced by the *Curriculum and Assessment Policy documents for Grades R – 12 (January 2011)*.

(d) 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* and 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 what is regarded to be knowledge,

skills and values worth learning. It will ensure that learners acquire and apply knowledge and skills in ways that are meaningful to their own lives. In this regard, the curriculum promotes the idea of grounding 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 our 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 sets 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 10 – 12 (General) 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.

1.4 Time Allocation

1.4.1 Foundation Phase

(a) The instructional time for subjects in the Foundation Phase is as indicated in the table below:

Subject	Time allocation per week (hours)
I. Home Language	**6**
II. First Additional Language	**4 (5)**
III. Mathematics	**7**
IV. Life Skills	**6**
• Beginning Knowledge	1 (2)
• Arts and Craft	2
• Physical Education	2
• Health Education	1

(b) Instructional time for Grades R, 1 and 2 is 23 hours. For Grade 3, First Additional Language is allocated 5 hours and Beginning Knowledge is allocated 2 hours as indicated by the hours in brackets in the table above.

1.4.2 Intermediate Phase

(a) The table below shows the subjects and instructional times in the Intermediate Phase.

Subject	Time allocation per week (hours)
I. Home Language	**6**
II. First Additional Language	**5**
III. Mathematics	**6**
IV. Science and Technology	**3.5**
V. Social Sciences	**3**
VI. Life Skills	**4**
• Creative Arts	1.5
• Physical Education	1.5
• Religion Studies	1

1.4.3 Senior Phase

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

Subject	Time allocation per week (hours)
I. Home Language	**5**
II. First Additional Language	**4**
III. Mathematics	**4.5**
IV. Natural Sciences	**3**
V. Social Sciences	**3**
VI. Technology	**2**
VII. Economic Management Sciences	**2**
VIII. Life Orientation	**2**
IX. Arts and Culture	**2**

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. Three Electives	**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.

CURRICULUM AND ASSESSMENT POLICY STATEMENT: LIFE SCIENCES

GRADE 10

INTRODUCTION

Four "*knowledge strands*" are used as organisers of the Life Sciences content framework. Each knowledge strand develops progressively over the three years of FET. Life Sciences is the study of Life at various levels of organisation. These knowledge strands are:

- life at the molecular, cellular and tissue level (Knowledge Strand 1)
- life processes in plants and animals (Knowledge Strand 2)
- environmental studies (Knowledge Strand 3)
- diversity, change and continuity. (Knowledge Strand 4)

None of the knowledge strands or the topics within each knowledge strand should be studied separately or independently. They are also not weighted equally as this classification is simply a tool to organise the subject content. When teaching Life Sciences it is very important to help learners link 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.

The knowledge 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. Instead, educators have the freedom to expand concepts and to design and organise learning experiences according to their local circumstances. All four knowledge strands must, however, be addressed in the Grade 10 year of study.

The identified cognitive and practical skills must be taught, and assessed, in an integrated way in the context provided by the four knowledge strands.

GRADE 10

The recommended **Grade 10** teaching sequence for the four knowledge strands is:

1. biosphere to ecosystems (environmental studies)
2. history of life and biodiversity (diversity, change and continuity)
3. molecules to organs (life at the molecular, cellular and tissue level)
4. life processes that sustain life (life processes in plants and animals)

The rationale for this order is that some areas of South Africa are best suited for an environmental study during spring and summer and also because seasonal comparisons in a chosen ecosystem are required where possible. It is important to retain the sequence of Knowledge Strand 1 before Knowledge Strand 2 and Knowledge Strand 3 before Knowledge Strand 4. Many learners might develop an aversion to Life Sciences if they start the FET phase with the more abstract Strands 3 and 4. However, 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 Natural 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 skills that they will need to acquire.

This should be done in the first lesson as an introduction but is **not** part of the assessable curriculum although the principles and skills will be assessed in the context of specific knowledge where applicable.

AIMS

There are **three** broad subject specific aims in Life Sciences.

1. Specific Aim 1 relates to the knowledge/content (theory).
2. Specific Aim 2 relates to doing science/practical work.
3. Specific Aim 3 relates to understanding the applications of Life Sciences in everyday life.

These three aims are aligned to the three Learning Outcomes with which teachers are familiar. Within each of these aims, specific skills or competencies 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 provide **evidence** that all the skills were assessed during the year. There must be a clear link between the aims and the outcomes of learning - the assessments are the link.

Whilst learner performance can be reported on separately for Specific Aims 1 (knowing) and 2 (doing) Science, all of Specific Aim 3 (science in society) can be integrated into either Specific Aim 1 or Specific Aim 2.

1. SPECIFIC AIM 1: ACQUIRING KNOWLEDGE OF LIFE SCIENCES (concepts, processes, phenomena, mechanisms, principles, theories, laws, models etc.)

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 level for the grade,** in a variety of assessments during the year. Note that not every skill will be assessed in every assessment but teachers must ensure that learners are assessed in all the skills during the course of the year.

1.1 ACQUIRE KNOWLEDGE

Skills

Learners must…

- **access** information from a variety of sources (teachers, reference books, textbooks, the internet, experts, peers, parents etc.)
- **select** key ideas obtained from resources
- **recall** and **describe** knowledge related to Life Sciences.

Assessments

To assess these competencies (or cognitive skills), teachers should use the following verbs in the tasks or assessments: state, name, label, list, define, describe, explain and any other verbs that would indicate that **knowledge** of the subject is being assessed.

1.2 UNDERSTAND AND MAKE MEANING OF LIFE SCIENCES

Skills

Learners must…

- **analyse** acquired knowledge
- **evaluate** acquired knowledge
- **synthesise** (or reorganise) knowledge to derive new meaning through written summaries, flow charts, diagrams, mindmaps etc.

Assessments

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

1.3 APPLY KNOWLEDGE OF LIFE SCIENCES IN NEW AND UNFAMILIAR CONTEXTS

Skills

Learners must…

- **analyse** and **evaluate** knowledge and **apply** this to new and unfamiliar contexts.

Assessment

To assess these competencies (cognitive skills), teachers should use the following verbs in the tasks or assessments: explain, interpret, predict, Compare, differentiate and select and any other appropriate verbs that will assess a learner's ability to apply knowledge. The key is that learners will have to apply knowledge about something that they had learnt, and which they understand, in a context/situation about which they have not yet acquired specific knowledge.

2. SPECIFIC AIM 2: INVESTIGATING PHENOMENA IN LIFE SCIENCES

The following range of skills relate to doing practical work in Life Sciences. All seven skills will not apply equally to every practical activity. The skills are aligned to what learners would be doing in the normal course of doing practical work. Teachers must select the applicable skills to be assessed in the context of specific activities. All seven skills must be assessed during the year **at the grade appropriate level**.

Learners must be able to:

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.

2.2. HANDLE EQUIPMENT/APPARATUS

This should include knowledge of the apparatus i.e. naming it and knowing what it is used for. It includes equipment such as a microscope or using a scalpel/blade for dissections as well as, for example, using more complex sets of apparatus and chemicals to

carry out food tests or to investigate photosynthesis. “Handle 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.

2.3. MAKE OBSERVATIONS

A variety of observations can be recorded in different ways:

- drawings
- descriptions
- grouping of materials/examples based on observable similarities and/or differences
- measurements
- comparing materials before and after treatment (e.g. food tests)
- observing results of an experimental investigation which will involve tabulating data
- counting populations.

2.4. RECORD INFORMATION/DATA

This should include the recording of observations or information as drawings, descriptions, tables or graphs etc. This “recording” skill is transferable to a range of different scientific activities.

2.5. MEASURE

Learners should know **what** to measure, **how** to measure it and should have a sense of the degree of accuracy required. A variety of things should be measured: length, volume, temperature, weight/mass and numbers (counting). Measuring is a way of quantifying observations and in this process learners should learn to estimate.

2.6. INTERPRET

Learners should be able to convert information from one format (the recorded form e.g. a table) to another (e,g, a table to a graph).

Learners should be able to perform appropriate 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, devise controls, control variables, make deductions based on evidence and recognise anomalies etc.

2.7. DESIGN/PLAN INVESTIGATIONS OR EXPERIMENTS

Designing an investigation is different to the planning of an investigation

Not all investigations are based on the “classic” dependent-independent variables and controls. An investigation could, for example, look at an ecosystem and the pH of its soil etc.

Skills include:

- identifying a problem
- hypothesising
- selecting apparatus/equipment and/or materials (including specific quantities of chemicals where necessary)
- planning an experiment
- identifying variables (dependent and independent)
- controlling variables/designing suitable controls
- stipulating measurements that must be taken, including frequency of measurements
- evaluating the experimental design
- suggesting ways of recording results
- understanding the need for replication/verification

In grade 10 learners should be assisted in planning and/or designing an investigation/experiment.

Note: Skills 2.1 to 2.6 (following instructions, handling equipment, making observations, recording information, measuring and interpreting information) would all be required in some form in order to carry out an experiment or investigation. By separating seven different kinds of skills (2.1 to 2.7), these skills can apply to the **variety** of different types of practical work that is appropriate for a particular grade in Life Sciences, including investigations/experiments. This approach makes it easier to assess learners in a range of different circumstances and it makes it possible for a teacher to make judgements about a learner's ability to **do** science. The skills are based on what learners will do in the normal course of doing practical work. However, there are some circumstances in which only some of these skills will apply. For example, for a dissection only 2.1, 2.2, 2.3 and 2.4 will apply while for an experiment on photosynthesis at least 2.1 to 2.6 will apply - and possibly even 2.7.

3. SPECIFIC AIM 3: APPRECIATING AND UNDERSTANDING THE IMPORTANCE AND APPLICATIONS OF LIFE SCIENCES IN SOCIETY

3.1. UNDERSTANDING THE HISTORY AND RELEVANCE OF SOME SCIENTIFIC DISCOVERIES

Skills

Learners must…

- **access** relevant information from appropriate sources
- **select** key ideas to construct the history of specific discoveries
- **describe** the history of specific discoveries from past and present cultures
- **evaluate** the relevance/importance of these specific discoveries for society.

As far as possible these aspects should be linked to and taught with topics and content where a discovery or the scientist is relevant.

3.2 RELATIONSHIP OF INDIGENOUS KNOWLEDGE TO LIFE SCIENCES

Note: Examples which are selected (examples should be selected from different South African cultural groupings as far as possible) **will** also link directly to specific areas in the Life Sciences subject content.

3.3 THE VALUE AND APPLICATION OF LIFE SCIENCES KNOWLEDGE IN INDUSTRY, FOR CAREER OPPORTUNITIES AND IN EVERYDAY LIFE

This is about the applications, impact and relevance that the 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 socio-biology and animal behaviour, plant pathology, game management, environmental impact studies, preservation of biodiversity, palaeontology, paleoanthropology, agriculture, horticulture, environmental law, science journalism, biotechnology and genetic engineering. Examples of some of the possible career opportunities are included at the appropriate topics. Learners should be made aware of careers but these should not be dealt with in great detail.

Skills

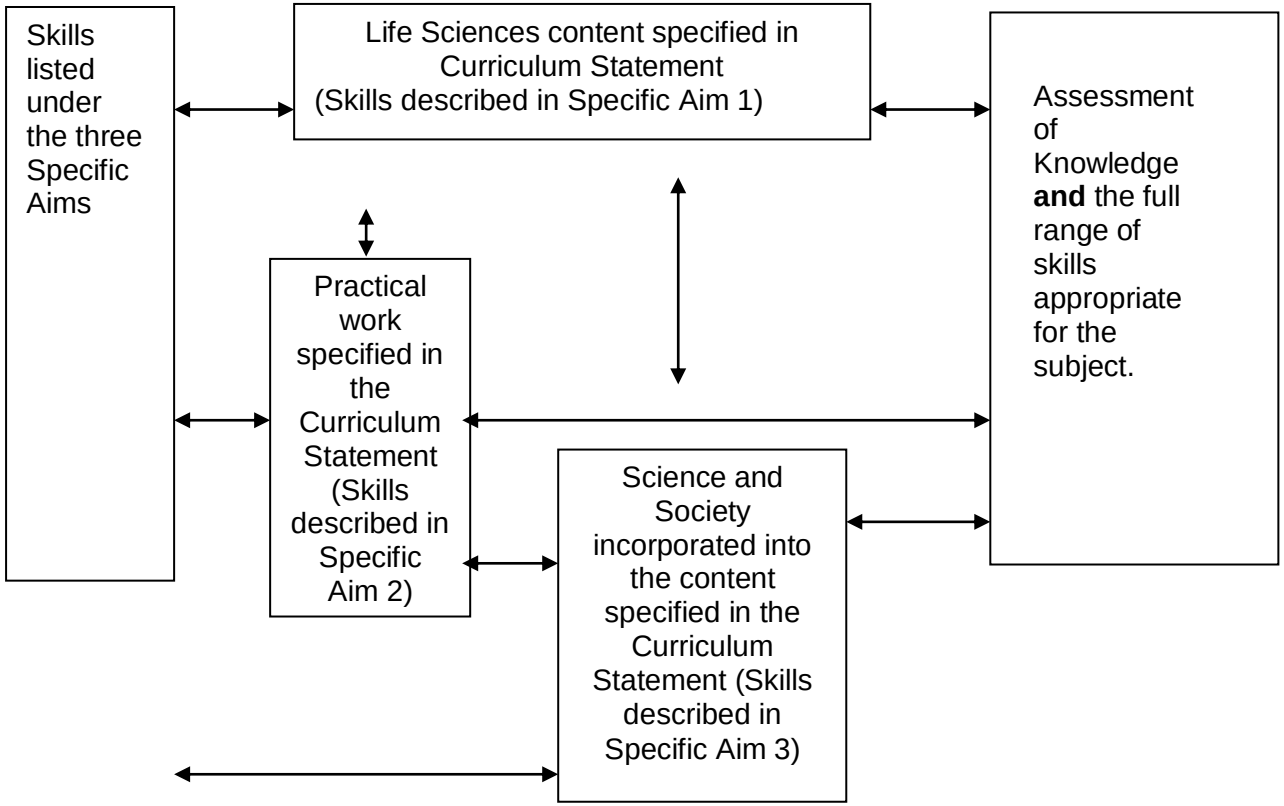
Learners must…

- **analyse** and **evaluate** the applications of Life Sciences in everyday life (both positive and negative consequences)
- **analyse**, **discuss** and **debate** the ethical and legal issues surrounding biotechnology.
- **explore** career opportunities related to Life Sciences.

FLOW DIAGRAM: RELATIONSHIPS BETWEEN THE KEY CURRICULUM ELEMENTS

The following diagram illustrates how the aims relate to learning outcomes, and to one another, and how the ranges of skills must be infused into the subject content.

- The diagram also shows how assessment relates to the content, the practical work and Science and Society as well as the skills.
- The diagram shows what has to be taught (Specific Aims 1, 2 and 3) of which the subject content provides the context for everything else.
- It shows the skills that must be taught and it shows how teachers should go about assessing the learners.
- The diagram illustrates the "infusion" of cognitive and other skills into everything that is taught and assessed.



TIME

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 time allocated per topic must serve as a guideline to teachers whilst allowing for some flexibility.

ASSESSMENT

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 intended aims specified for Life Sciences.
Assessment should be both informal and formal. In both cases, regular feedback should be provided to learners to enhance the learning experience. both informal and formal assessments it is important to:

- cover all of the subject content
- include the full range of skills
- use a variety of different forms of assessment.

Informal assessment

Regular assessments are part of the planned teaching and learning activities that take place in the classroom. Informal assessment can occur in every lesson. It can take the form of informal assessment tasks at the beginning, during or at the end of the lesson. This can be done through questions and answers, class work such as short pieces of written work completed during the lesson, open book tests, worksheets or homework exercises etc. It should not be seen as separate from the learning activities taking place in the classroom and should be used to provide feedback to learners and to improve learning and teaching.

Learners or teachers can make informal assessments. Self-assessment and peer assessment actively involves learners in assessment and allows learners to learn from and reflect on their own performance. This should be encouraged and learners in Grade 10 may need to be assisted during the initial stages.

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.

Informal assessments do not need to be recorded unless the teacher wishes to do so. In such instances, a simple checklist may be used to record this assessment and to provide feedback.

The results of informal assessments do not have to be taken into account when determining a learner's final mark for promotion or certification purposes.

Formal assessment

Formal assessment provides teachers with a systematic way of evaluating how well learners are progressing in a grade and in a particular subject.

The tasks used for formal assessment are recorded and used to determine whether learners are making progress and if they should be promoted to the next grade.

The teacher must plan and submit the annual formal Programme of Assessment to the School Management Team (SMT) at the start of the school year. This will be used to draw up a school assessment plan in each grade. Learners and parents should be provided with the school assessment plan during the first week of the first term.

Examples of formal assessments include projects, oral presentations, practical task, class tests, examinations, etc. For Life Sciences, teachers should identify possible projects suggested by the curriculum.

Formal assessments form part of a year-long formal programme of assessment in each grade and subject. Formal assessments are school-based and are weighted as follows for the different grades:

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%

The cognitive demands of assessment used should be **appropriate for the age and developmental level** of the learners in the grade. The assessment tasks should be carefully designed to cover the content of the subject as well as the range of skills that have been identified in the Specific Aims. The design of these tasks should therefore ensure that a variety of content and skills are assessed. Aims, topics, content and skills in the subject should be used to inform the planning and development of assessment tasks.

Formal assessments in Life Sciences must cater for a range of cognitive levels and abilities of learners.

Assessment of content

Specific Aims 1.1 and 3.2. (knowing, remembering)	Specific Aims 1.2 and 3.1 (understanding, applying)	Specific Aims 1.3 and 3.3 (analysing, evaluating, creating)
40%	30%	30%

Teachers should take care to design every assessment in such a way that there is evidence that this weighting of skills has been achieved. If there is such evidence, it will not be necessary to report on the specific aims separately.

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

ASSESSMENT REQUIREMENTS FOR LIFE SCIENCES: GRADE 10

Note: The number of tests per term is loosely based on the number of topics.

<table>
<tr><td colspan="5">PROGRAMME OF FORMAL ASSESSMENT</td></tr>
<tr><td colspan="3">FORMAL, RECORDED, SCHOOL-BASED ASSESSMENTS</td><td colspan="2">END-OF-YEAR INTERNAL EXAMINATIONS 75%</td></tr>
<tr><td colspan="2">CONTENT</td><td>PRACTICAL</td><td>WRITTEN EXAMINATIONS (2½ HRS)</td><td>PRACTICAL EXAMINATIONS (1HR)</td></tr>
<tr><td colspan="2">• 6 tests
• 1 midyear examination
• 1 project (can be done in any term)</td><td>A selection of 7 representative practical tasks, which cover the range of skills, must be marked and recorded. (The marks allocated for a practical task should range from 10 to 30).</td><td>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>Practical knowledge and skills

20%= 15 marks</td></tr>
<tr><td colspan="3">SCHOOL-BASED ASSESSMENT (during the year)</td><td colspan="2">75</td></tr>
<tr><td>TERM 1</td><td>TERM 2</td><td>TERM 3</td><td>TERM 4</td><td rowspan="3"></td></tr>
<tr><td>• 2 tests
• 2 selected practical tasks</td><td>• 1 test
• 2 selected practical tasks
• Midyear examination (2½hrs)</td><td>• 2 tests
• 2 selected practical tasks
• Environmental studies: fieldwork</td><td>• 1 test
• 1selected practical task
• Practical examination (1hr)</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>75%</td></tr>
</table>

Note: The number of formal class tests specified per term is the minimum that is required. In terms 2 and 4, a single test is required. However, a single mark in a term does not necessarily accurately reflect the abilities of all learners. If possible, teachers should try to enable learners to write more than one test in these terms.

RECORDING

Recording is a process in which the teacher documents the level of a learner's performance. Teachers record the actual raw marks against the task using a record sheet. Records of learner performance should also be used to verify the progress made by teachers and learners in the teaching and learning process. Records should be used to monitor learning and to plan ahead.

POSSIBLE TEMPLATE FOR RECORDING LEARNER PERFORMANCE

Teachers may elect to adopt this template or they may wish to develop their own.

All formal tasks must be recorded (on this or any other template). All conversions must be reflected.

Names	TERM 1				TERM MARK **A**		TERM 2				TERM MARK **B**		TERM 3					TERM MARK **C**		TERM 4		TERM MARK **D**	
	TEST 1	TEST 2	PRAC 1	PRAC 2			TEST 3	PRAC 3	PRAC 4	EXAM			TEST 4	TEST 5	PRACK 5	PRACK 6	FIELD W			TEST 6	PRAC 7		
Max	70	50	25	30	175	%	60	15	25	200	300	%	50	70	15	20	40	195	%	60	30	90	%
1. Learner 1	31	28	17	20	96	*55	37	9	14	157	217	*72	31	39	10	13	23	116	*59	32	18	50	56
2. Learner 2 etc.																							

The project may be completed in any term. The marks for the project should be added to the prescribed minimum number of assessments for that term.

CALCULATING TERM MARKS

In order to calculate the **TERM MARK** for TERM 1

Learner 1 gets the following marks:

- Test 1 : $^{31}/_{70}$
- Test 2 : $^{28}/_{50}$
- Prac 1 : $^{17}/_{25}$
- Prac 2 : $^{20}/_{30}$

The total for the term is $^{96}/_{175}$

This is 55% $(^{96}/_{175} \times {}^{100}/_{1} = 55\%)$

This is the **TERM MARK** for **TERM 1** (**at A)**

The learner qualified for rating code 4: Adequate Achievement

In the same way calculate the term marks for each of **TERM 2 (72%) at B, TERM 3 (59%) at C** and **TERM 4 (56%) at D.**

NAMES	WRITTEN EXAMINATION		CONVERSIONG	PRACTICAL EXAMINATION		CONVERSION**G**	EXAMINATION MARK **(F+G)**
Max	200	%	60	80	%	15	75
1. Learner 1	163	82	49	51	64	10	59
etc.							

CALCULATING THE EXAMINATION MARKS

- It is important to remember that these examinations **together** count 75 of the 100 marks for the **FINAL MARK.** This is determined by Departmental policy.
- The written examination counts **80%** of the 75 marks. **This means that the examination marks must be converted to a mark out of 60.**
- The practical examination counts **20%** of the 75 marks. **This means that the practical mark must be converted to a mark out of 15.**

For example:

- Learner 1 gets $^{163}/_{200}$.for the written examination and $^{51}/_{80}$ for the practical examination.

- Conversion of **written examination** mark:

$$^{163}/_{200} \times {}^{100}/_{1} = \mathbf{82\%} \left(^{82}/_{100}\right)$$

and

$$^{82}/_{100} \times {}^{60}/_{1} =$$ 49 marks out of 60 at F

- Conversion of the **practical examination** mark:

$$^{51}/_{80} \times {}^{100}/_{1} = \mathbf{64\%} \left(^{64}/_{100}\right)$$

and

$$^{64}/_{100} \times {}^{15}/_{1} =$$ 10 marks out of 15 at G

- The **total** for the two examination marks (F+G) is therefore **49+10** = 59 out of 75 at H **EXAMINATION MARK**

CALCULATING THE FINAL MARK

- In Grade 10 the term marks for terms 1, 2, 3 and 4 **each** count 25% (¼) of the YEAR MARK i.e. they are weighted equally and the YEAR MARK counts 25% of the FINAL MARK. This is Departmental policy.

	TERM 1 (A)	TERM 2 (B)	TERM 3 (C)	TERM 4 (D)	TOTAL (A)+(B)+(C)+(D)	CONVERSION YEAR MARK	EXAMINATION MARK	EXAMINATION MARK	FINAL MARK
	100	**100**	**100**	**100**	**400**	**25**	75	25	100
1. Learner 1	**55**	**72**	**59**	**56**	**242 %**	**15**	59	15	74
2. Learner 2									

etc.

In order to calculate the **FINAL MARK,** the **YEAR MARK** for the 4 terms (converted to a **mark** out of 25) must be added to the **EXAMINATION MARK** (converted to a mark out of 75) as follows:

- First convert the 4 term marks to a mark out of 25:
  T1(A) + T2(B) +T3(C)+T4(D)
  55 + 72 + 59 + 56 = $^{242}/_{400} \times {}^{25}/_{1} =$ 15 marks **YEAR MARK (E)**
- Lastly add the **year mark** 15(at E), to the **exam mark** 59 (at H) = 74% **FINAL MARK**

Learner 1 therefore gets 74% which is 6 on the rating scale: Meritorious Achievement

Reporting

Reporting is a process of communicating learner performance to learners, parents, school, districts and other stakeholders such as the employers, tertiary institutions, etc.

In Grades R -12, teachers report in percentages against the subject, using the following scale:

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.

LIFE SCIENCES: GRADE 10

TERM 1	
TIME	**INTRODUCTION TO LIFE SCIENCES: SUBJECT ORIENTATION**
½ Week **(2 hrs)**	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) • observing • designing an investigation • making measurements and the importance of scaling • presenting data in the form of drawings, written descriptions, tables and graphs • identifying patterns and relationships in data • societal aspects of scientific evidence • communicating findings • 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 • general introduction to the range of skills that must be developed • limitations of scientific evidence

	• introduction to graphs: different kinds of graphs and when to use them; interpreting graphs. Organisation of learning: • laboratories, classrooms, groups • procedures, safety, apparatus, chemicals • assessment requirements • Careers and subject combinations for entrance to Higher Education. **Note:** This introduction is not assessable. However, the relevant aspects must be assessed in the context of the specific content where applicable.

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.

TIME	TOPIC	CONTENT	PRACTICALWORK	RESOURCES
3 weeks (12 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 water. **Organic compounds** • Carbohydrates – monosaccharides (single sugars) e.g. glucose, fructose,	Construct models of simple and more complex molecules. **Essential:** Food tests for starch, glucose, lipids and proteins.	Textbook Charts **Equipment** Test tubes Chemicals Bunsen burners

		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 saturated fats. Cholesterol in foods. Heart disease. • 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. Lock and key model of how enzymes work. Influence of temperature and pH on enzyme action. Enzymes in everyday life, e.g. washing powders. • Nucleic acids: DNA and RNA – Consist of C, H, O, N and P(no details of structure required) • Vitamins (e.g. A, B, 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)* • 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	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. Analyse nutritional content on food packaging: vitamins, minerals and other nutritional content.	Thermometers Washing powder or H_2O_2 and chicken liver or pineapple juice, egg white, plastic drinking straws Selection of Food packaging showing nutritional content

		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)* • Need for fertilisers in overutilised soils e.g. where crops are grown and regularly harvested, problem of fertilizers washed into rivers, and eutrophication. *(Link to ecology)* • Careers in plant and animal nutrition, e.g. dietician.	Compare Recommended Daily Allowance (RDA) with usual diet of individual learners. Draw a pie chart of the food types and discuss implications.	
2½weeks (10 hrs)	**Cells: the basic units of life**	• Molecular make-up: Cells are mostly made of proteins, carbohydrates, lipids, nucleic acids and water History of microscopy: from lens to light and then electron microscopes and transmission election microscopes. How the development of microscopes by Hooke, van Leeuwenhoek and others 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** • Cell wall – support structure • Cell membrane – boundaries and transport, fluid mosaic model. • Movement across membranes**:** diffusion, osmosis and active transport • Nucleus, chromatin material, nuclear membrane, nucleopores, nucleolus: the control centre, heredity. • Cytoplasm – storage, circulation of materials	• 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	Textbook Charts micrographs microscope slides Chemicals Electron micrographs (in text books) Transparent ruler Bioviewers and biostrips

		• Mitochondria – powerhouses of the cell, release of energy • Ribosomes – protein synthesis • Endoplasmic reticulum (rough and smooth) - transport systems • Golgi body – packaging centre • 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.)* Differences between plant and animal cells **Cells differ** in size, shape and structure in order to carry out specialised functions *[link to tissues]*	• calculate the size of specimen on a micrograph using the scale provided • investigate diffusion • investigate osmosis	Beakers, salt, potatoes or eggs.
1½ weeks (6hrs)	**Cell division – mitosis**	**The cell cycle including mitosis:** interphase, mitosis, cytokinesis, growth. Division of cell to form two identical cells. *(Simple description with diagrams to show changes to chromosomes so that one parent cell forms two identical daughter cells. Names of phases not required.)* **Chromosomes**: In nuclei of all cells, two chromatids, centromere. **Role of mitosis:** growth, repair and reproduction in some simple organisms. **Cancer**: uncontrolled cell division and growth. - Causes of cancer	Use suitable resources to examine cell division e.g. microscope slides, micrographs, posters, models. Record observations as drawings.	Textbook Charts micrographs/ microscope slides Microscope

		- Beliefs and attitudes concerning cancer. - Treatment of cancer: - Traditional technology e.g. traditional medicines and healers - Medical biotechnology e.g. radiotherapy and chemotherapy - (no detail required) • Research and present information on ONE of the cancers. This must include causes, prevalence and treatment.		
2 weeks (8 hrs)	**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 and epidermis • Animal tissues: 4 basic types i.e. epithelial, connective, muscle and nerve tissue and some examples of each. *[No detail required – some tissues, e.g. blood, will be covered in more detail in relevant sections]* Indigenous knowledge systems and biotechnology • Traditional technology e.g. traditional medicines and healers • Medical biotechnology e.g. immunity, antibiotics, blood transfusion • Cloning of plant and animal tissues and stem cell research; ethics and legislation: • Collect information on ONE field of biotechnology related to plant or animal	Examine and identify some plant and animal tissues using microscope, biostrips, micrographs or posters. Draw cells that make up these tissues to show specialised structure. .	Textbook Charts Microscope slides Micrographs Microscope

		tissues e.g. cloning, stem cell research, in vitro fertilisation. Careers in biotechnology.		
½week **(2 hrs)** **Total** **10 weeks** **(40 hrs)**	**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.)* **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.	Observe and draw a section of a dicotyledonous leaf Options: – make a wet mount of a cross section of a leaf. – use prepared slides. – use micrographs.	Textbook Charts Micrographs/ microscopes Scalpel/blade Glass slides and cover slips or prepared slides or micrographs Stain
ASSESSMENT		2 formal class tests, homework, worksheets Refer to the range of skills listed under Specific Aims 1 and 3	2 Practical tasks. 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) and which make energy available to organisms in order to stay alive (cellular respiration) are covered first. Animal nutrition considers how different animals obtain and process their energy sources depending on their habitat. Gas exchange between an organism and its environment is necessary for photosynthesis and cellular respiration to take place.

TIME	TOPIC	CONTENT	PRACTICAL WORK	RESOURCES
3 weeks (12 hrs)	**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. *(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 The role of carbon dioxide enrichment, optimum light and optimum temperatures in greenhouse systems to improve crop yields. (*Link to*	**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	Textbook Living plants Suitable equipment Chemicals

		Grade 10 and 11 environmental issues.) **Role of ATP** as an important energy carrier in the cell	photosynthesis • chlorophyll is necessary for photosynthesis. • oxygen is produced during photosynthesis. or • data can be provided and interpreted by learners.	
4 weeks (16 hrs)	**Animal nutrition (mammals)**	The relationships between food intake, energy, growth and health requirements. Balanced diet and changing requirements with age, gender and activity levels. • herbivorous, carnivorous and omnivorous lifestyles in terms of nutritional requirements and energy relationships. Differences in respect of dentition, alimentary canal and energy requirements *(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	Calculate the nutritional value of a meal/diet. Use dietary information or food packaging.	Textbook Selection of food packaging Newspapers Popular magazines

		egestion and the significance of each. • **Mechanical or physical digestion:** types and functions of different kinds of teeth, processes of chewing and peristalsis. • **Chemical digestion: Enzymes*:*** function of carbohydrases, proteases and lipases with respect to where produced, substrate and end-products *(Specific enzymes need not be named – link to molecular structures and 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 rest of the body. • ***Assimilation:*** role of the liver: glucose metabolism, deamination of excess amino acids, and the breakdown of alcohol, drugs and hormones. **Homeostatic control: Hormonal control** of blood sugar level. Increase of people affected by diabetes in recent years. • different diets: cultural, religious, personal and health choices in	Dissection of a small mammal (obtained by ethical and legitimate	DVD/Video to show

		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. • Effects of alcohol and drug abuse and the dangers associated with their misuse. • Tooth decay related to diet. Fluoride in water supplies and its effect on teeth	means) to observe the alimentary canal Record observation as a drawing or Obtain intestines of a sheep from a butcher and record observations in drawings. (Dissection can be done at the **end** of this topic)	dissection in progress Small mammal Scalpel Dissecting board Pins
(continued)	**Energy transformations to sustain life**. **(continued)**	• **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 or oxidative phosphorylation. *(No biochemical detail is required)*	Investigate or demonstrate respiration by showing that: • oxygen is used by living organisms. • carbon dioxide is produced by living organisms or	Textbook Snails or seedlings Chemicals Appropriate equipment

		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.	• provide relevant data that can be interpreted by learners.	
2 weeks **(8 hrs)**	**Gas exchange**	• 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 (e.g. metamorphosis of amphibians to cope with the transition from aquatic to terrestrial life) and in plants. Describe how the requirements stated above are met in relation to an organism's habitat, structure and its surface area: volume ratio with reference to the following organisms: a dicotyledonous plant, an earthworm, an insect, a bony fish and a mammal. Human gas exchange: The structure (macro and tissue level), location, adaptations and function of the ventilation system (trachea,	Use the **same** dissection to observe and draw or describe the lungs, trachea, bronchi etc. of the breathing system of a small mammal. or Obtain lungs, associated diaphragm, pulmonary blood vessels and heart from a butcher. Use books end on end and one on top of the other to measure the surface area to volume ratio. • Constuct a model of the human	Textbook (See dissection above)

		bronchi, bronchioles, lungs and alveoli) Ventilation of the lungs; gaseous exchange in alveoli; transport of gases around body; gaseous exchange in tissues. Composition of inspired air vs. expired air – analyse data, homeostatic control of breathing Respiratory disorders: origins, symptoms and treatment of TB in South Africa. Other disorders e.g. asthma, hay fever, bronchitis, emphysema and lung cancer. The effects of smoking on gaseous exchange. Artificial respiration – effect of mouth-to-mouth resuscitation Analysis and interpretation of data showing effects of altitude on gaseous exchange, e.g. performance of athletes in Johannesburg versus Cape Town or Durban	breathing system. Explain the limitations of the model Measure and compare depth of breathing of two people and the effect of exercise on breathing rate or Interpret data on depth and rate of breathing. Analysis and interpretation of data showing effects of altitude on gaseous exchange, e.g. performance of athletes in Johannesburg versus Cape Town or Durban. Demonstrate that expired air contains carbon dioxide	
Total				

9 weeks (36hrs)				
ASSESSMENT		1 formal class test, worksheets, homework, midyear examination (2½ hrs+1hr). Refer to range of skills listed under Specific Aims 1 and 3.	2 practical tasks. Refer to range of skills specified under Specific Aim 2.	

TERM 3

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 contexts in Grade 11.

TIME	TOPIC	CONTENT	PRACTICAL WORK	RESOURCES
7 weeks (28 hrs)	**Biosphere to ecosystems**	• **Biosphere** Concept of the biosphere. Inter-connectedness with and components of global ecosystem: hydrosphere, lithosphere, atmosphere. • **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. • **Ecosystems** Concept of ecosystem. • ***Abiotic and biotic factors***: Effects on community structure and ecosystem functioning.	**Fieldwork** **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 in the ecosystem over 2	Textbook Field guides Keys Access to an ecosystem Map of South Africa DVD s The Internet Nature programmes on TV

		Biotic factors: – producers – consumers – decomposers 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)* • ***Energy flow*** through ecosystems and relationship to trophic structure • Trophic levels: producers, consumers (herbivores and carnivores), decomposers *(link with nutrition)* • Food chains, food webs and food pyramids • Flow charts of the following: ***nutrient cycles***, water, oxygen, carbon and nitrogen *[Names e.g. nitrates are required but no detail of chemistry is necessary]* • Ecotourism: economics, ethics and opportunities	terms: either terms 1 and 2 or terms 3 and 4. – biodiversity within the ecosystem using field guides and keys. – positive and/or negative human impact/influence on the ecosytem. Different groups should investigate different factors. Each group must plan, collect, record and present data as well as analyse and evaluate data. *(This serves as an introduction/link to human influences on the environment in Grade 11)*	

		• Environmental issues: current environmental issues e.g. global warming, pollution, greenhouse effect, acid rain, monoculture, overpopulation (mention only link with grade 12). • Careers in Environmental Studies, e.g. conservation, environmental law, environmental impact studies, water treatment, horticulture, environmental education.		
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 has 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 and movements of continents and oceans over long periods of time.				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
1 week (4 hrs)	**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. Classification schemes as a way of organising biodiversity. History of classification: Scientists attempt to classify organisms based on shared features. As information increases classification changes. One of the currently accepted classification system is the Five-kingdom system: Plantae, Animalia, Fungi, Protista and Monera (Bacteria)	Principles of classification: grouping everyday objects on the basis of shared similarities. A simple nested hierarchy.	Textbook Photographs Micrographs Selection of everyday objects Identification guides Keys Appropriate instruments for measuring abiotic factors

TOTAL **8 weeks** **(32hrs)**		Naming things in science: species concept and binomial system. Linnaeus and his role in classification systems. why do we use Latin? Differences between prokaryotes and eukaryotes *(link to cell structure).* Main groupings of living organisms are bacteria, protists, fungi, plants and animals. Diagnostic features of each of the following: **Bacteria** **Protists** **Fungi** **Plants** **Animals**	Classify a selection of familiar organisms into groups based on visible evidence. Use keys and identification guides	Identification guides Keys Photographs
ASSESSMENT		2 formal class tests, worksheets, homework. Refer to range of skills listed under Specific Aims 1 and 3.	2 selected practical tasks Practical fieldwork: group investigations. Refer to range skills listed under Specific Aim 2.	

TERM 4				
STRAND 4: (Continued)				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
5 weeks (20 hrs)	**History of life on Earth**	**Palaeontology: study of fossils** **Fossil formation and methods of dating** e.g. radiometric dating and relative dating. **Geological timescale** – meaning and use of *(details not to be memorised)* Scientists use deductive reasoning (inference) to understand fossils and the 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); bivalves and ammonites on the Makhatini flats in northern KZN, whale fossils in the Sahara *(extension of GET work)* The three eras: Paleozoic, Mesozoic and Coenozoic. Each era divided into periods *(Names of periods not to be memorised)* **Cambrian explosion:** origins of early forms of all animal groups. Life-forms have gradually changed to become present life-forms, but even in the last million years significant changes have occurred in species occurring in	Examine fossils at a museum or fossil site or look at photographs of fossils. Optional: use of plaster of Paris to construct a "fossil". 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. The timeline should emphasise the long history of life. Research the "missing link" between dinosaurs and birds (*Archaeopteryx),* research the "link" between fish	Textbook Map If possible, access to a museum, or fossil site or photographs or DVDs Reference books

		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). 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)* **Key events** in life's history for which there is evidence from southern Africa. (locations should be identified on a map): • Origins of the earliest forms of life: evidence of fossilised bacteria (stromatolites) from caves (e.g. in the Barberton district, Mpumalanga and many other caves) • Soft-bodied animals in Namibia • Early land plants in the Grahamstown area • Forests of primitive plants such as *Glossopteris* (near Mooi River and Estcourt) which form most of the coal deposits in southern Africa. Location of coal deposits in South Africa	and amphibians (Coelacanth) or the "link" between reptiles and mammals (*Thrinaxodon*). Various hypotheses have been proposed for the extinction, 65 million years ago, such as the meteorite impact theory and the vulcanism in India and South Africa theory. Select ONE of these hypotheses and describe the evidence scientists have gathered in support of it. (*Nature of science)*	

TOTAL 5 weeks (20 hrs)		• The Coelacanth as a "living fossil" of the group that is ancestral to amphibians • Mammal-like reptiles in the Karoo (e.g. *Lystrosaurus* and *Thrinaxodon* • Dinosaurs (Drakensberg and Maluti mountains) (*Euskylosaurus* from Lady Brand in the Free State) and cone-bearing plants • First mammals (Eastern Cape and Lesotho) • Humans (Gauteng, Free State, KwaZulu-Natal, Western Cape, Limpopo) The impact of humans on biodiversity and the natural environment. Fossil tourism: source of income and employment in some fossil localities. Careers in paleantology and paleoanthropology.		
ASSESSMENT		1 formal class test, worksheets, homework. End of year examination (2½hrs). Refer to range of skills specified under Specific Aims 1 and 3	1 practical task. Practical examination (1hr) Note: The practical work done during the year must develop the range of practical skills described in Specific Aim 2. The practical examination will assess some of these skills.	

CURRICULUM AND ASSESSMENT POLICY STATEMENT: LIFE SCIENCES

GRADE 11

INTRODUCTION

Four *knowledge strands* are used as organisers of the Life Sciences content framework. Each knowledge strand develops progressively over all three years of FET. These knowledge strands are:

- diversity, change and continuity
- life processes in plants and animals
- environmental studies
- life at molecular, cellular and tissue level.

None of the knowledge strands or the topics within each knowledge strand should be studied separately or independently as this classification is simply a tool to organise the subject content. When teaching Life Sciences, it is very important to help learners link 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.

The knowledge 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. Instead, educators have the freedom to expand concepts and to design and organise learning experiences according to their local circumstances. The four knowledge strands are used to create links across the grades from Grade 10 to 12.

The identified cognitive and practical skills must be taught and assessed in an integrated way in the context provided by the four knowledge strands.

The recommended **Grade 11** teaching sequence for the four knowledge strands are:

1. Strand 1: diversity, change and continuity
2. Strand 2: life processes in plants and animals
3. Strand: environmental studies
4. Strand 4: (life at molecular, cellular and tissue level) is not covered in Grade 11.

AIMS

4. There are **three** broad aims in Life Sciences. Specific Aim 1 relates to the knowledge/content (theory).
5. Specific Aim 2 relates to doing science/practical work.
6. Specific Aim 3 relates to understanding the applications of Life Sciences in everyday life.

These three aims are aligned to the three Learning Outcomes with which teachers are familiar. Within each of these aims, specific skills or competencies 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 provide **evidence** that all the skills were assessed during the year. There must be a clear link between the aims and the outcomes of learning - the assessments are the link.

Whilst learner performance can be reported separately for Specific Aims 1 (knowing) and 2 (doing Science), Specific Aim 3 (Science and Society) must be integrated into either Specific Aim 1 or Specific Aim 2.

1. SPECIFIC AIM 1: ACQUIRING KNOWLEDGE OF LIFE SCIENCES (concepts, processes, phenomena, mechanisms, principles, theories, laws, models, etc.)

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 level for the grade, in a variety of assessments during the year. Note that not every skill will be assessed in every assessment. Teachers must ensure that learners are assessed in all skills during the course of the year.

2.1 Acquire knowledge

Skills

Learners must…

- **access** information from a variety of sources (teachers, reference books, textbooks, internet, experts, peers, parents etc).
- **select** key ideas obtained from resources
- **recall** and **describe** knowledge related to Life Sciences.

Assessments

To assess these competencies (cognitive skills), teachers should use the following verbs in the tasks or assessments: *state*, *name*, *label*, *list*, *define*, *describe*, *explain* and any other verbs that indicate that **knowledge** of the subject is being assessed.

2.2 Understand and make meaning of life sciences

Skills

Learners must…

- **analyse** acquired knowledge
- **evaluate** acquired knowledge
- **synthesise** (or reorganise) knowledge to derive new meaning through written summaries, flow charts, diagrams and mindmaps.

Assessments

To assess these competencies (cognitive skills), teachers should use the following verbs in the tasks or assessments: *explain*, *compare*, *rearrange*, *give an example of*, *illustrate*, *calculate*, *interpret*, *suggest a reason*, *generalise*, *interpret information/data*, *analyse, predict*, *select*, *differentiate*, or any other suitable verbs that indicate that an understanding of the subject is being assessed.

2.3 Apply knowledge of life sciences in new and unfamiliar contexts

Skills

Learners must…

- **analyse** and **evaluate** knowledge and apply this to new and unfamiliar contexts.

Assessments

To asses these competencies (skills), teachers should use the following verbs in the tasks or assessments: explain, interpret, predict, compare, differentiate, select and any other appropriate verbs that will assess a learner's ability to apply knowledge. The key is that learners will have to apply knowledge about something that they had learnt, and which they understand, in a context/situation about which they have not yet acquired specific knowledge.

4. SPECIFIC AIM 2: INVESTIGATING PHENOMENA IN LIFE SCIENCES

The following range of skills relate to doing practical work in Life Sciences. All seven skills will not apply equally to every practical activity. Teachers must select the applicable skills to be assessed in the context of specific activities. All seven skills must be assessed during the year. The skills that have been identified are based on the things that learners would have to do in the normal course of their practical work.

Learners must be able to:

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.

2.2. Handle equipment/apparatus

This should include knowledge of the apparatus, i.e. naming it and knowing what it is used for. It includes equipment such as a

microscope or a scalpel/blade used for dissections and more complex sets of apparatus and chemicals to carry out food tests or to investigate photosynthesis. "Handle equipment" is generic and would apply to many different types of

investigations and the use of many different types of apparatus. Handling improvised equipment requires the same skills as would handling standard laboratory equipment.

2.3. Make observations

A variety of observations can be recorded in different ways:

- drawings
- descriptions
- grouping of materials/examples based on observable similarities and/or differences
- measurements
- comparing materials before and after treatment (e.g. food tests)
- observing results of an experimental investigation which will involve tabulating data.
- counting populations.

2.4. Record information/data

This should include the recording of observations or information as drawings, descriptions, tables or graphs. This recording skill is transferable to a range of different practical scientific activities. The skill could also be assessed in other contexts, such as tests and examinations.

2.5. Measure

Learners should know **what** to measure, **how** to measure it and should have a sense of the degree of accuracy required. A variety of things should be measured: length, volume, temperature, weight/mass,

and numbers (counting). Measuring is a way of quantifying observations and in this process learners should learn to estimate. This skill could also be assessed in other contexts.

2.6. Interpret

Learners should be able to convert information from one format (the recorded form, e.g. a table) to another (e.g. from a table to a graph).. Learners should be able to perform appropriate calculations, extract information from tables and graphs, apply knowledge of theory to practical situations, recognise patterns and/or trends, appreciate the limitations of experimental procedures, devise controls, control variables, make deductions based on evidence and recognise anomalies. This skill can also be assessed in other contexts.

2.7. Design/plan investigations or experiments

Designing an investigation is different to the planning of an investigation.

Not all investigations are based on the classic dependent-independent variables and controls. An investigation could, for example, look at population densities and estimate populations through various sampling methods.

Grade 11 learners may initially need assistance in planning and/or designing an investigation/experiment.

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Skills include:

- identifying a problem
- hypothesising
- selecting apparatus/equipment and/or materials (including specific quantities of chemicals where necessary)
- planning an experiment
- identifying variables (dependent and independent)
- controlling variables/designing suitable control
- stipulating measurements that must be taken (including frequency of measurements)
- evaluating the experimental design
- suggesting ways of recording results
- understanding the need for replication/verification.

Note: Skills 2.1 to 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 (2.1 to 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 investigations/experiments.

This approach makes it easier to assess learners in a range of different circumstances and it makes it possible for a teacher to make judgements about 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. For example, for a dissection only 2.1, 2.2, 2.3 and 2.4 would apply and for a photosynthesis experiment, at least 2.1 to 2.6 would apply and possibly also 2.7.

5. 3. SPECIFIC AIM 3: APPRECIATING AND UNDERSTANDING THE IMPORTANCE AND APPLICATIONS OF LIFE SCIENCES IN SOCIETY

3.1. Understanding the history and relevance of some scientific discoveries

Skills

Learners must…

- **access** relevant information from appropriate sources
- **select** key ideas to construct the history of specific discoveries
- **describe** the history of specific discoveries from past and present cultures.
- **evaluate** the relevance/importance of these specific discoveries for society.

As far as possible, these aspects should be linked to and taught with topics and content where a particular discovery or the scientists are relevant.

3.2. Relationship between indigenous knowledge and Life Sciences

Note: The selected examples (from different South African cultural groupings as far as possible) should link directly to specific areas in the Life Sciences subject content.

3.3 The value and application of Life Sciences knowledge in industry and everyday life, and career opportunities in Life Sciences

This area covers the relevance of Life Sciences knowledge in society. Examples presented to students in class should be relevant to the subject content covered at any particular time.

Career opportunities in the Life Sciences should be brought to the attention of learners throughout the course; these include socio-biology and animal behaviour, plant pathology, game management, environmental impact studies, preservation of biodiversity, palaeontology, paleo-anthropology, agriculture, horticulture, environmental law, science journalism, biotechnology and genetic engineering. Although learners should be made aware of the range of career opportunities, these should not be dealt with in great detail.

Skills

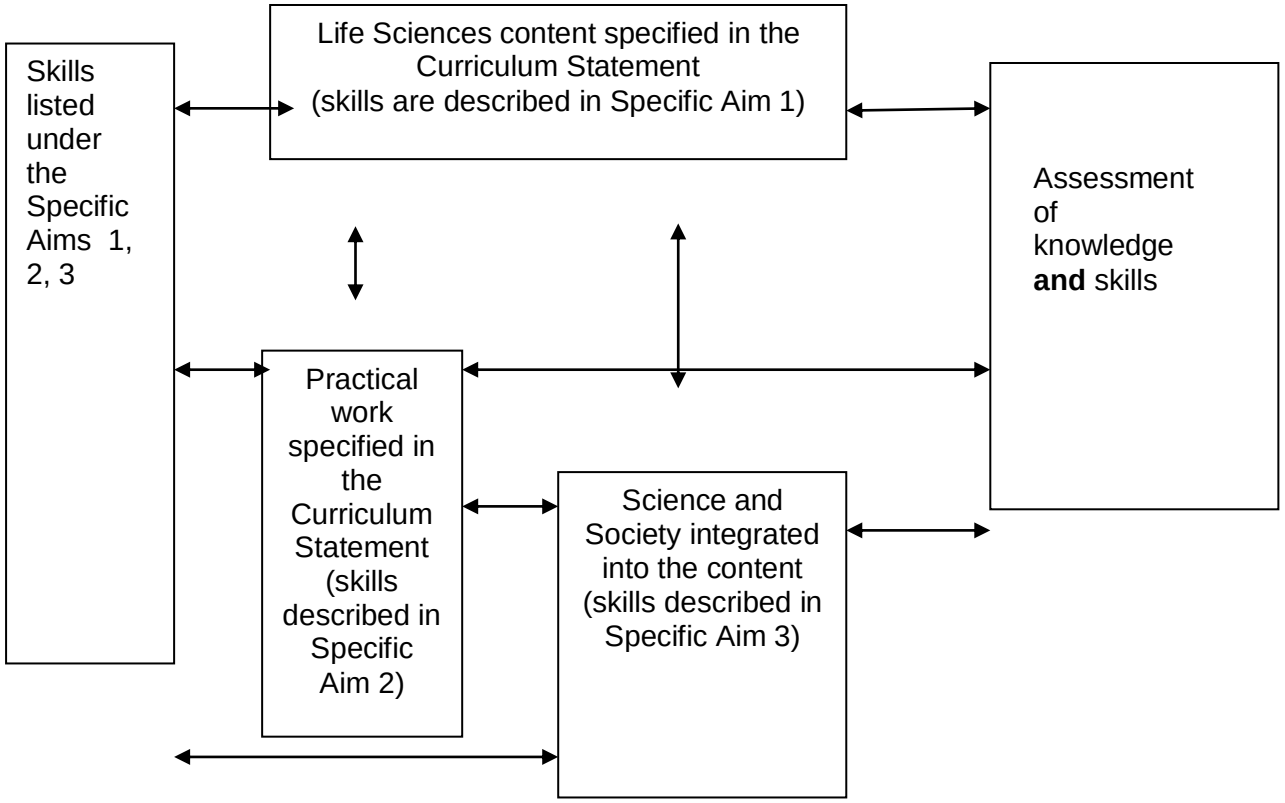
Learners must…

- **analyse** and **evaluate** the application of Life Sciences in everyday life (both positive and negative consequences)
- **analyse**, **discuss** and **debate** the ethical and legal issues related to biotechnology
- **explore** career opportunities in Life Sciences.

FLOW DIAGRAM: RELATIONSHIPS BETWEEN THE KEY CURRICULUM ELEMENTS

The following diagram illustrates how the three Specific Aims relate to Learning Outcomes and to one another and how the ranges of skills must be infused into the subject content. The diagram:

- indicates how assessment relates to the content, the practical work, Science in Society, and the skills
- specifies what has to be taught (Specific Aims 1, 2 and 3) in which context
- states the skills to be taught and the assessments to be done. illustrates the infusion of skills in teaching and assessment activities.



TIME

The Grade 11 curriculum is taught over 32½ of the 40 weeks of the school year. This leaves 8 weeks in the school year for examinations, tests and possible disruptions due to other school activities. The time allocated per topic is a guideline only.

ASSESSMENT

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 learners.

Assessment should be mapped against the content, Specific Aims and Outcomes for Life Sciences.

Assessment should be both informal and formal. In both cases, regular feedback should be provided to learners to enhance the learning experience. In both informal and formal assessments it is important to:

- cover all of the subject content
- include the full range of skills
- use a variety of different forms of assessment.

Informal assessment

Regular assessments form part of the teaching and learning activities of the classroom.

Informal assessment can occur in every lesson, at any stage of the lesson. This can be done through questions and answers, class work (e.g. short pieces of written work completed during the lesson), open-book tests or homework exercises. These assessment activities should not be seen as separate from the learning activities in the classroom and should be used to provide feedback to learners to improve learning and teaching.

Informal assessments can be scored by teachers or learners. Self-assessment and peer assessment actively involves learners and allows them to learn from and reflect on their own performance. Learners may need assistance and encouragement to cope with their involvement in the scoring of assessments.

Informal, continuous assessment should be used to structure the acquisition of knowledge and skills and should be used as preparation for the formal tasks in the Programme of Assessment.

Informal assessments need not be recorded, unless the teacher wishes to do so. In such instances, a simple checklist may be used to record this assessment and to provide feedback.

The results of informal assessments do not have to be taken into account when determining a learner's final work for promoting or certification purposes.

Formal assessment

Formal assessment provides teachers with a systematic way of evaluating how well learners are progressing in a grade and a particular subject.

Formal assessment tasks are recorded and used to determine whether learners should be promoted to the next grade.

Teachers have to submit their annual formal Programme of Assessment to the School Management Team (SMT) before the start of the school year. This will be used to draw up a school assessment plan in each grade. The school assessment plan should be provided to learners and parents in the first week of the first term.

Examples of formal assessments include projects, oral presentations, practical tasks, tests and examinations. Possible projects for Life Sciences are suggested in the curriculum.

Formal assessments are part of the continuous programme of assessment in each grade and subject. Formal assessments are school-based and are weighted as follows for the different grades:

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 the mid-year examination)	75%
12	25% (including school-based mid-year examinations)	External examination: 75%

Teachers should ensure that in **each well-designed** assessment this weighting is reflected to avoid having to report on these weightings separately.

The cognitive demands of the assessment should be appropriate to the age and developmental level of the learners in the grade.
The assessment tasks should be carefully designed to cover the content of the subject as well as the range of skills stated in the Specific Aims. The design of these tasks should therefore ensure that a variety of content and skills are assessed. Objectives, topics and content in the subject should be used to inform the planning and development of assessment tasks.

It is necessary to maintain a balance in respect of the cognitive demands when designing formal assessments (class tests) to assess theory (content); the following weightings apply to Life Sciences.

Assessment of content

Specific Aims 1.1 and 3.2 (knowing, remembering)	Specific Aims 1.2 and 3.1 (understanding, applying)	Specific Aim 1.3 and 3.3 (analysing, evaluating, creating)
40%	30%	30%

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

ASSESSMENT REQUIREMENTS FOR LIFE SCIENCES: GRADE: 11

<table>
<tr><td colspan="5">PROGRAMME OF FORMAL ASSESSMENT</td></tr>
<tr><td colspan="3">Formal school-based assessments 25 %</td><td colspan="2">End-of-year internal examinations 75%</td></tr>
<tr><td colspan="2">CONTENT</td><td>PRACTICAL</td><td>WRITTEN EXAMINATIONS
(3 hrs)</td><td>PRACTICAL EXAMINATIONS
(1½ hrs)</td></tr>
<tr><td colspan="2">• 7 tests
• 1 mid-year examination
• 1 project (can be done in any term)</td><td>A selection of seven representative practical tasks, which cover the range of skills, must be marked and recorded. (The marks allocated for practical tasks should range between 10 and 30.)</td><td>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 exam.
85%=64 marks.</td><td>Practical knowledge and skills
15%= 11 marks.</td></tr>
<tr><td colspan="3"></td><td colspan="2">75</td></tr>
<tr><td>TERM 1</td><td>TERM 2</td><td>TERM 3</td><td>TERM 4</td><td rowspan="2"></td></tr>
<tr><td>• 2 tests
• 2 selected practical tasks</td><td>• 2 tests
• 2 selected practical tasks
• mid-year examination (3 hrs)</td><td>• 2 tests
• 2 selected practical tasks</td><td>• 1 test
• 1 practical task
• environmental study</td></tr>
<tr><td>25%</td><td>25%</td><td>25%</td><td>25%</td><td></td></tr>
<tr><td colspan="3">Convert to 25%</td><td colspan="2">75%</td></tr>
</table>

RECORDING

Recording is a process in which the teacher documents the level of a learner's performance. Teachers record the actual raw marks against the task using a record sheet.

Records of learner performance should also be used to verify the progress made by teachers and learners in the teaching and learning process. Records should be used to monitor learning and for future planning.

Possible template for recording learner performance

Teachers may elect to adopt this template or they may wish to develop their own. All formal tasks must be recorded (on a template). All conversions must be reflected.

Names	TERM 1				TERM MARK A		TERM 2					TERM MARK B		TERM 3				TERM MARK C		TERM 4			TERM MARK D	
	TEST 1	TEST 2	PRAC 1	PRAC 2			TEST 3	TEST 4	PRAC 3	PRAC 4	EXAM			TEST 5	TEST 6	PRAC 5	PRAC 6			TEST 7	PRAC 7	EXAM STUDY		
Max	60	60	20	30	170	%	50	60	20	25	300	455	%	50	60	25	25	160	%	60	30	30	110	%
1. Learner 1	34	36	13	21	104	61	35	38	14	18	170	275	60	31	39	19	16	105	66	42	18	24	80	73
2. Learner 2 etc.																								

The project can be completed in any term. The marks for the project should be added to the prescribed minimum number of assessments for the term in which it is completed.

Calculating term marks

Example

Calculation of the **TERM MARK** for **TERM 1.**

Learner 1 gets the following marks:

Test 1: $^{34}/_{60}$

Test 2: $^{36}/_{60}$

Prac1: $^{13}/_{20}$

Prac2: $^{21}/_{30}$

The total for the term is $^{104}/_{170}$.

The percentage for the term is $^{104}/_{170}$ x $^{100}/_{1}$ = 61%

This is the **TERM MARK** for **TERM 1(at A)**

The learner qualified for a rating code at 5: Substantial Achievement.

- In the same way, calculate the term marks for each of **TERM 2 (60%) at B, TERM 3 (66%) at C** and **TERM 4 (73% at D)**

NAMES	Written Examination		CONVERSION**F**	PRACTICAL EXAMINA-TION		CONVERSION**G**	EXAM MARK **(F+G)** **H**
Max	300	%	60	70	%	15	75
1. Learner 1	237	79	47	39	56	8	55
2. Learner 2 etc.							

Calculating the exam mark

- It is important to remember that the exams, **together,** count 75 of the 100 marks for the **FINAL MARK.** This is determined by Departmental Policy.
- The written exam counts 80% of the 75 marks. This means that the written exam mark **must be converted to a written mark out of 60.**
- The practical exam counts 20 % of the 75 marks. This means that the practical exam mark **must be converted to a mark out of 15.**

Example:

- Learner 1 gets $^{237}/_{300}$ for the written exam and $^{39}/_{70}$ for the practical exam.
- Conversion of the written exam mark

$^{237}/_{300}$ x $^{100}/_{1}$ = 79 % ($^{79}/_{100}$)

and

$^{79}/_{100}$ x $^{60}/_{1}$ = 47 marks out of 60 of F

- Conversion of practical exam mark

$^{39}/_{70}$ x $^{100}/_{1}$ = 56% ($^{56}/_{100}$)

and

$^{56}/_{100}$ x $^{15}/_{1}$ = 8 marks of 15 of G

The total for two exam marks (F + G) is therefore 47+8 = 55 out of 75 of H

EXAM MARK

Calculating the final mark

In Grade 11, the term marks for terms 1, 2, 3 and 4 each count 25% (¼) of the YEAR MARK, i.e. they are weighted equally and the YEAR MARK counts 25% of the **FINAL MARK.**

	TERM 1 (A)	TERM 2 (B)	TERM 3 (C)	TERM 4 (D)	TOTAL (A)+(B)+(C)+(D)	CONVERSION YEAR MARK **E**
MAX	**100**	**100**	**100**	**100**	**400**	**25**
1. Learner 1	**61**	**60**	**66**	**73**	**260**	**16**
2. Learner 2						

etc.

EXAM MARK **H**	YEAR MARK **E**	FINAL MARK
75	**25**	**100**
55	**16**	**71**

Example:

In order to find the **FINAL MARK,** the **YEAR MARK** for the 4 terms (converted to a mark out of 25) must be added to the **EXAM MARK** (converted to a mark out of 75) as follows:

- First convert the 4 term marks to a mark out of 25:
  T1 (A) + T 2 (B) + T 3 (C) + T 4 (D)

  61 + 60 + 66 + 73 = $^{260}/_{400}$ x $^{25}/_{1}$ = 16 marks: **YEAR MARK (E)**

- Lastly, add the **year mark** 16 (at E) to the **exam mark** 55 (at H) = **71 % FINAL MARK**
  Learner 1 therefore gets 71% which is 6 on the rating scale: Meritorious Achievement

Reporting

Reporting is a process of communicating learner performance to learners, parents, school, districts and other stakeholders such as employers and tertiary institutions.

In Grades R -12, teachers report in percentages against the subject, using the following scale:

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.

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.				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
3 weeks (12 hrs)	**Biodiversity and classification of micro-organisms**	**Biodiversity** ● Microorganisms: basic structure and general characteristics of the following groups *(links with Grade 10)* — viruses — bacteria — protista — fungi (Macroscopic organisms in the protista and fungi should only be mentioned- not studied in detail) ● 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)*	• Where possible, the prevalence of bacteria should be demonstrated by growing cultures on agar plates.	Textbook Reference books Charts

		• effect and management of at least **one** disease from each of the four groups: – viruses (rabies, HIV/AIDS, influenza) – bacteria (blight, cholera, tuberculosis, anthrax) – protists (malaria) – fungi (rusts, thrush, ringworms, athletes foot) • immunity: immune response of plants and animals against infecting micro-organism; vaccinations • use of drugs, e.g antibiotics; effect on micro-organisms • careers in Microbiology and/or Botany	• Look for evidence of bacterial/ fungal diseases on plants (school, home)	
3 weeks (12 hrs)	**Biodiversity and of plants** **Reproduction in plants**	• grouping of plants according to the presence/absence of – vascular tissue (xylem and phloem) – true leaves and roots – seeds or spores – fruit – water for reproduction. • **asexual and sexual reproduction:** advantages and disadvantages of each • **alternation of generations** (link to genetics: haploidy and diploidy) Changes in respect of dominance of gametophyte to sporophyte phases in respect of:	Observe and draw plants (or relevant parts); provide examples of each of the following divisions: – bryophytes – pteridophytes – gymnosperms – angiosperms Observe and draw specimens (or parts of specimens) to illustrate	Text book Identification guides/ keys Hand lens Microscope Prepared Microscope slides or Micrographs Charts Models Hand lens Microscope

		- moss (Bryophyte) - fern (Pteridophyte) - flowering plant (Angiosperm) **Flowers as reproductive structures:** Adaptationsof flowers for pollination; (**different** pollinators) wind, an insect, bird (South African examples **only);** differences and similarities **Significance of seeds** • endemic species in South Africa. • careers in Botany, Horticulture, Conservation, Forestry, etc.	alternation of generations Dissect an example of each of the following types flowers: • wind pollinated • insect pollinated • bird pollinated Record observations as drawings Germinate seeds: record process	Prepared slides or micrographs Flowers scalpel or blade hand lens Micrographs

1 ½ weeks (6 hrs) **Total 7½ weeks (30hrs)**	**Biodiversity of animals: invertebrates**	• 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 grouped according to key features in respect of body plans: – symmetry – number of tissue layers developed from embryo – coelom – structure of gut Relationship between body plans and modes of living: – similarities and differences	• Calculate approximate surface area: volume ratios of selected examples. • Observe examples from as many phyla as possible (photographs). • Select one phylum and compile a poster to show diversity in that phylum in South Africa. • Construct a comparative table of these six phyla.	Textbook Reference books DVDs
ASSESSMENT		2 class tests, worksheets, homework. Refer to the list of skills in Specific Aims 1 and 3 in order to include as many skills as possible in the assessments.	2 practical tasks. Evidence of the practical skills that have been identified in Specific Aim 2 must be reflected in the practical tasks.	

TERM 2				
STRAND 2 : life processes in plants and animals In this knowledge strand 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. Excretion in humans is also studied.				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
3 weeks (12hrs)	**Support and transport systems in plants.**	• anatomy of dicotyledonous plants: • root and stem: distribution of different tissues (leaf done in Grade 10) • structure of cells in different tissues (recap of Grade 10) • secondary growth (link to cell division in Grade 10); annual rings in a tree trunk to assess age and to measure climate change • uptake of water and minerals into roots • transport of water and minerals to leaves • transpiration: relationship between water loss and leaf	• Use a microscope or micrographs to observe and draw cross sections of root and stem. • Use microscope to observe and draw cells of the following: – epidermis – xylem – phloem • Investigate water uptake through the roots *(link to osmosis in Grade 10).* • Investigate water movement through xylem (use impatiens if possible). • Investigate the effect of temperature, light intensity or humidity on transpiration rate.	Textbook Microscopes Prepared slides Coloured ink/food colouring Potometer Beakers Soft plant e.g. Busy Lizzie, Impatiens

		structure (link to Grade 10), Factors that affect the rate of transpiration: temperature, light intensity, wind, humidity), wilting guttation • translocation of manufactured substances from leaves to other parts of plant • careers in Botany, Plant Pathology, Plant Biochemistry.	(use of simple potometer) • Observation of annual rings in a cut tree to assess age and climatic changes	Simple Potometer Beakers Leafy twigs
3 weeks (12 hrs)	**Support systems in animals**	• skeletons: examples of animals with hydrostatic skeleton, endoskeleton, exoskeleton: advantages and disadvantages • human skeleton: the axial and apendicular skeleton (names of bones forming the skull are not required) • functions of skeleton: movement, protection, support, storage of minerals, hearing • structure of a long bone • relationship between structure and function of the following tissues: *(link to Grade 10)* – bone – cartilage – tendons – ligaments • joints: fixed, partly movable, freely movable (synovial): structure of a synovial joint • roles of the following in human locomotion: bones,	• Observe human skeleton (model or photographs). • Observe and draw a typical longbone: transverse and longitudinal sections • Use prepared slides to observe and draw selected tissues. • 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. • Use microscope slides/ micrographs to observe and draw	Textbook Model Photographs Selection of cut long bones (from butchery) X-rays (if possible) Microscope Prepared slides or Micrographs

		joints, ligaments, tendons, antagonistic muscles (e.g. biceps/triceps). • structure of skeletal muscle: myofibrils and muscle contraction • diseases that affect the skeleton, e.g. rickets in children, osteoporosis, arthritis. • careers in medicine, Bio-engineering, Pathology, etc.	skeletal muscle tissue.	
3 weeks (12 hrs)	**Transport systems in mammals (human)**	• blood circulation system: pulmonary and systemic (double, closed) circulatory system – heart and associated blood vessels – lungs and pulmonary system, associated blood vessels – major organs and systemic system: associated major blood vessels of brain, small intestine, liver, kidneys • direction of blood flow: difference between oxygenated and deoxygenated blood in different parts of the system (diagram or schematic drawing) *(links to Grade 10)* • blood vessels: structure and functioning or arteries, veins and capillaries • heart: internal and external structure related to functioning	*(Refer to dissection of breathing system Grade 10)* • dissection of mammal heart (sheep, cow or pig) obtained from a butchery • In pairs, measure the pulse before and after exercise. Record, interpret and explain data presented as a graph.	Textbook Charts Microscope prepared slides or micrographs

Total **9 weeks** **(36 hrs)**		• cardiac cycle: flow of blood through the heart • mechanisms for controlling cardiac cycle and heart rate (pulse) • blood and lymph tissues: structure and function of constituent parts • relationship between blood system and lymphatic system • functions of lymphatic system • diseases of the heart and circulatory system: high and low blood pressure, heart attacks, strokes • careers in medicine, nursing, paramedicine, pathology, etc.	• Observe and draw prepared microscope slides or micrographs of blood cells and blood vessels.	
Assessment		2 class tests, worksheets, homework summaries, mid-year examination (3hrs). Note: Refer to the range of skills specified in Specific Aims 1 and 3.	2 practical tasks. Note: Refer to the range of skills specified in Specific Aim 2.	

TERM 3				
STRAND 2: life processes in plants and animals (continued)				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
2 ½ weeks (10 hrs)	**Excretion in humans**	• excretion in various organs: 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, reabsorption of glucose and some salts • nephron: structure and functioning; filtration,	Dissection of a small mammal, e.g. rat (obtained legally and ethically) Observe and draw urinary tract Dissection of sheep or pig kidney (obtained from butchery) Observe and draw	Textbook Charts Model Small mammals Scalpel/blade Dissecting board Pins Scissors

		reasbsorption, formation of urine • diseases affecting kidney function, e.g. kidney stones, kidney failure due to overuse of some painkillers • homeostatic control of water and salts: role of ADH and aldosterone. • dialysis • careers in medicine, nursing, Biochemistry, physiology, Biokinetics, etc.		

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	PRACTICAL WORK	RESOURCES
6 weeks (24 hrs)	**Population ecology**	• **Intraspecific competition:** food; water, space; shelter; access to mates, survival determined by access; ecological niches	Case study: rationale for culling, e.g. elephants in KNP	Textbook Reference Books Posters Charts

		• **Population size**: immigration, emigration, mortality, births; fluctuations, limiting factors, carrying capacity, logistic growth curve (phases) • **Human population:** reasons for exponential growth. Age and gender distributions for different countries (including South Africa); forecast for South Africa's population growth over the next twenty years; possible consequences for the environment • **Social organisation:** benefits of herds/flocks (avoidance); packs (hunting) dominance; division of tasks (castes) • **Community structure:** producers, consumers, decomposers *(link to Grade 10)* • **Interactions:** - **Predation:** two South African examples of predator- prey relationships - **Competition:** (interspecific) for light,	Determine size of population, sampling – quadrant – simulated mark/recapture Collect and record data, interpret data Calculate/estimate population size	Brochures Field guides DVD's (if possible) Newspapers Magazines

Total		space, water, shelter, food. Specialisation; competitive exclusion and resource partitioning: one example of coexistence in animals, one example in plants – **Parasitism:** two examples from southern Africa – **Mutualisms:** two examples from South Africa: both species benefit **Two** examples from South Africa: one of the species benefits • **Community change over time: Succession**: primary and secondary succession; possible endpoints depending on environmental fluctuations • Careers in Environmental Studies, Environmental Impact Assessments, Environmental Law, Conservation, Environmental Journalism	Design and make a poster to illustrate the life cycle of an animal parasite. Survey: research questionnaire on the appeal of South Africa's biodiversity; representative sample within the school. Collect and analyse data; present data as a graph. Interpret data. Identify and record, over time, one example of succession in or close to the school grounds (e.g. in the goal area on the sports field at the end of the season)	

8½ weeks (34 hrs)				
ASSESSMENT		1 class test, worksheets, homework summaries, end-of-year examination (2hrs) Note: Refer to the range of skills specified in specific Aims 1 and 3.	1 practical task, practical examination (1 ½ hrs) Note: Refer to the range of skills specified in Specific Aim 2.	

TERM 4				
STRAND 3 **Environmental studies (continued)** **NOTE: Environmental studies must be completed in Grade 11 but this topic will be examined in the National Senior Certificate at the end of Grade 12.**				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
7 weeks (28hrs)	**Human influences: impact on the environment (links to Grade 10)**	• **Pollution of air, water and land:** impact on environment, consequences for human health Possible solutions in each of the following contexts: • **Global environmental issues:** ozone depletion, Greenhouse Effect: importance for sustaining life on earth, enhanced Greenhouse Effect, Global Warming • **National environmental issues:** deforestation, overgrazing, desertification	Practical investigation of ONE example of human influence on the environment in the local area (e.g.impact of alien species on biodiversity, impact of overgrazing on bio-diversity, impact of monoculture on biodiversity, impact of water pollution on a river ecosystem, waste from an oil refinery on a local community, smoke from burning coal on a local community, impact of solid waste landfill on the environment, littering; impact of golf estates on water table and biodiversity, poaching.	Textbook Reference books Field guides Reports in the media Microscope Water testing kits Share- Net booklets

		Crops and commercial forests; water table, monoculture effects on biodiversity; deposits of toxic substances in rivers Introduction of invasive alien species into South Africa: impact on biodiversity, control mechanisms • **Local environmental issues** Exploitation versus sustainability of local indigenous resources such as devil's claw, rooibos, fynbos, African Potato, Hoodia, pepperbark tree. • **Environmental changes caused by humans** *(link to Grade 10)* Food pyramids and food webs to interpret environmental changes eg. destruction of fauna and flora by pollution in streams, rivers, sea; eutrophication of rivers; impact of acid rain; impact of deforestation on producers and consumers; effects of insecticides on consumers; effects of culling on consumers; overpopulation on producers and consumers .	• **Identify** the problem • **Identify** the causes • **Collect** information/data • **Analyse** information/data • **Suggest** possible solutions • **Present** findings in an appropriate way, e.g. poster or report/assignment and/or presentation • **Write** an article for a newspaper. • **Produce** a flyer to draw local attention to the problem. **and** • **Develop** a plan of action to solve the problem. • **Report** on the success of the action (Note: the investigation can be done individually or in groups with members of the group investigating different aspects	

Total **7 weeks** **(28 hrs)**		• **Sustaining the environment:** management and treatment of domestic waste and effluents from industry; Reduction of emissions through more sustainable use of resources		
ASSESSMENT	2 class tests, worksheets, summaries, flow diagrams. Note: refer to the range of skills specified in Specific Aims 1 and 3.	2 class tests, worksheets, summaries, flow diagrams. Note: refer to the range of skills specified in Specific Aims 1 and 3.	2 practical tasks, one of which is the environment study. Note: refer to the range of skills specified in Specific Aim 2.	

CURRICULUM AND ASSESSMENT POLICY STATEMENT: LIFE SCIENCES

GRADE 12

INTRODUCTION

Four *knowledge strands* are used as organisers of the Life Sciences content framework. Each knowledge strand develops progressively over the three years of FET. These knowledge strands are:

- life at molecular, cellular and tissue level
- diversity, change and continuity
- life processes in plants and animals
- environmental studies (will not be covered in Grade 12 and should be taught in the fourth term of Grade 11 since the topic will be examined in the National Senior Certificate examination at the end of Grade 12).

None of The knowledge strands or the topics within each knowledge strand should be studied separately or independently as this classification is simply a tool to organise the subject content. When teaching Life Sciences, it is very important to help learners link to 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.

The knowledge 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. Instead, educators have the freedom to expand concepts and to design and organise learning experiences according to their local circumstances.

The identified cognitive and practical skills must be taught and assessed in an integrated way in the context provided by the four knowledge strands.

The recommended Grade 12 teaching sequence for the four knowledge strands is:

5. Strand 1: life at molecular, cellular and tissue level
6. Strand 2: diversity, change and continuity
7. Strand 3: life processes in plants and animals
8. Strand 4 (continued): diversity, change and continuity

AIMS

There are **three** broad aims in Life Sciences.

7. Specific Aim 1 relates to the knowledge/content (theory).
8. Specific Aim 2 relates to doing science/practical work.
9. Specific Aim 3 relates to understanding the applications of Life Sciences in everyday life.

These three aims are aligned to the three Learning Outcomes with which teachers are familiar. Within each of these aims, specific skills or competencies 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 provide **evidence** that all the skills were assessed during the year. There must be a clear link between the aims and the outcomes of learning - the assessments are the link.

Whilst learner performance can be reported separately for Specific Aims 1 (knowing) and 2 (doing Science), Specific Aim 3 (Science in Society) must be integrated into either Specific Aim 1 or Specific Aim 2.

1. SPECIFIC AIM 1: ACQUIRING KNOWLEDGE OF LIFE SCIENCES (concepts, processes, phenomena, mechanisms, principles, theories, laws, models, etc.).

The following cognitive (thinking) skills comprise the range of skills that all learners should develop in the context of working through the content specified in the curriculum in a school year. These skills also indicate what should be assessed, at the appropriate level for the grade, in a variety of assessments during the year. Note that not every skill will be assessed in every assessment. Teachers must ensure that learners are assessed in all skills during the course of the year.

2.4 Acquire knowledge

Skills

Learners must…

- **access** information from a variety of sources (teachers, reference books, textbooks, the internet, experts, peers, parents, etc.).
- **select** key ideas obtained from resources
- **recall** and **describe** knowledge related to Life Sciences.

Assessments

To assess these competencies(cognitive skills), teachers should use the following verbs in the tasks or assessments: *state*, *name*, *label*, *list*, *define*, *describe*, *explain* and any other verbs that indicate that **knowledge** of the subject is being assessed.

2.5 Understand and make meaning of life sciences

Skills

Learners must…

- **analyse** acquired knowledge
- **evaluate** acquired knowledge
- **synthesise** (or reorganise) knowledge to derive new meaning through written summaries, flow charts, diagrams and mind maps.

Assessments

To assess these competencies (cognitive skills), teachers should use the following verbs in the tasks or assessments: *explain*, *compare*, *rearrange*, *give an example of*, *illustrate*, *calculate*, *interpret*, *suggest a reason*, *generalise*, *interpret information/data*, *analyse, predict*, *select*, *differentiate*, or any other suitable verbs that indicates that an understanding of the subject is being assessed.

2.6 Apply knowledge of life sciences in new and unfamiliar contexts

Skills

Learners must…

- **analyse and evaluate knowledge and apply this to new and unfamiliar contexts.**

Assessment

To asses these competencies (skills), teachers should use the following verbs in the tasks or assessments: explain, interpret, predict, compare, differentiate, select and any other appropriate verbs that will assess a learner's ability to apply knowledge. The key is that learners will have to apply knowledge about something that they had learned, and which they understand, in a context/situation about which they have not yet acquired specific knowledge.

6. SPECIFIC AIM 2: INVESTIGATING PHENOMENA IN LIFE SCIENCES

The following range of skills relate to doing practical work in Life Sciences. All seven skills will not apply equally to every practical activity. Teachers must select the applicable skills to be assessed in the context of specific activities. All seven skills must be assessed during the year.

Learners must be able to:

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.

2.2. Handle equipment/apparatus

This should include knowledge of the apparatus, i.e. naming it and knowing what it is used for.

It includes equipment such as a microscope or a scalpel/blade used for dissections and more complex sets of apparatus and chemicals to carry out food tests or to investigate photosynthesis . "Handle equipment" is generic and would apply to many different types of investigations and the use of many different types of apparatus. Handling improvised equipment requires the same skills as would handling standard laboratory equipment.

2.3. Make observations

A variety of observations can be recorded in different ways:

- drawings
- descriptions
- grouping of materials/examples based on observable similarities and/or differences
- measurements
- comparing materials before and after treatment (e.g. food tests)
- observing results of an experimental investigation which will involve tabulating data
- counting populations.

2.4. Record information/data

This should include the recording of observations or information as drawings, descriptions, tables or graphs. This recording skill is transferable to a range of different practical scientific activities.

2.5. Measure

Learners should know what to measure, how to measure it and should have a sense of the degree of accuracy required. A variety of things should be measured: length, volume, temperature, weight/mass, and numbers (counting). Measuring is a way of quantifying observations and in this process learners should learn to estimate.

2.6. Interpret

Learners should be able to convert information from one format (the recorded form, e.g. a table) to another (e.g. from a table to a graph). Learners should be able to perform appropriate calculations, extract information from tables and graphs, apply knowledge of theory to practical situations, recognise patterns and/or trends, appreciate the limitations of experimental procedures, devise controls, control variables, make deductions based on evidence and recognise anomalies.

2.7. Design/plan investigations or experiments

Designing an investigation is different to the planning of an investigation.

Not all investigations are based on the classic dependent-independent variables and controls. An investigation could, for example, look at population densities and estimate populations through various sampling methods.

Grade 12 learners should be able to plan and/or design an investigation/experiment with minimal assistance.

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Skills include:

- identifying a problem
- hypothesising
- selecting apparatus/equipment and/or materials (including specific quantities of chemicals where necessary)
- planning an experiment
- identifying variables (dependent and independent)
- controlling variables/designing suitable control
- stipulating measurements that must be taken (including frequency of measurements)
- evaluating the experimental design
- suggesting ways of recording results
- understanding the need for replication/verification.

Note: Skills 2.1 to 2.6 (following instructions, handling equipment, making observations, recording information, measuring and interpreting information) would all be required in some form to **carry out** an experiment or investigation. By separating the seven different skills (2.1 to 2.7), these skills can be applied to a **variety** of practical work appropriate for a particular grade in Life Sciences, including investigations/experiments. This approach makes it easier to assess learners in a range of different circumstances and it makes it possible for a teacher to make judgments about a learner's ability to **do** science. The skills are based on what learners would do in the normal course of practical work. However, there are some circumstances in which only some of these skills would apply. For example, for a dissection, only 2.1, 2.2, 2.3 and 2.4 would apply and for a photosynthesis experiment at least 2.1 to 2.6 would apply, and possibly also 2.7.

7. SPECIFIC AIM 3: APPRECIATING AND UNDERSTANDING THE IMPORTANCE AND APPLICATIONS OF LIFE SCIENCES IN SOCIETY

3.1. Understanding the history and relevance of some scientific discoveries

Skills

Learners must…

- **access** relevant information from appropriate sources
- **select** key ideas to construct the history of specific discoveries
- **describe** the history of specific discoveries from past and present cultures
- **evaluate** the relevance/importance of these specific discoveries for society.

These aspects should be linked to and taught with topics and content relevant to a discovery or scientists.

3.2. Relationship between life sciences and indigenous knowledge

Note: The selected examples (from different South African cultural groupings as far as possible) should link directly to specific areas in the Life Sciences subject content.

3.3 The value and application of Life Sciences knowledge in industry and everyday life, and career opportunities in Life Sciences

This area covers the relevance of Life Sciences knowledge in society. Examples presented to students in class should be relevant to the subject content covered at any particular time.

Career opportunities in the Life Sciences should be brought to the attention of learners throughout the course; these include socio-biology and animal behaviour, plant pathology, game management, environmental impact studies, preservation of biodiversity, palaeontology, paleo-anthropology, agriculture, horticulture, environmental law, science journalism, biotechnology and genetic engineering. Although learners should be made aware of the range of career opportunities, these should not be dealt with in great detail.

Skills

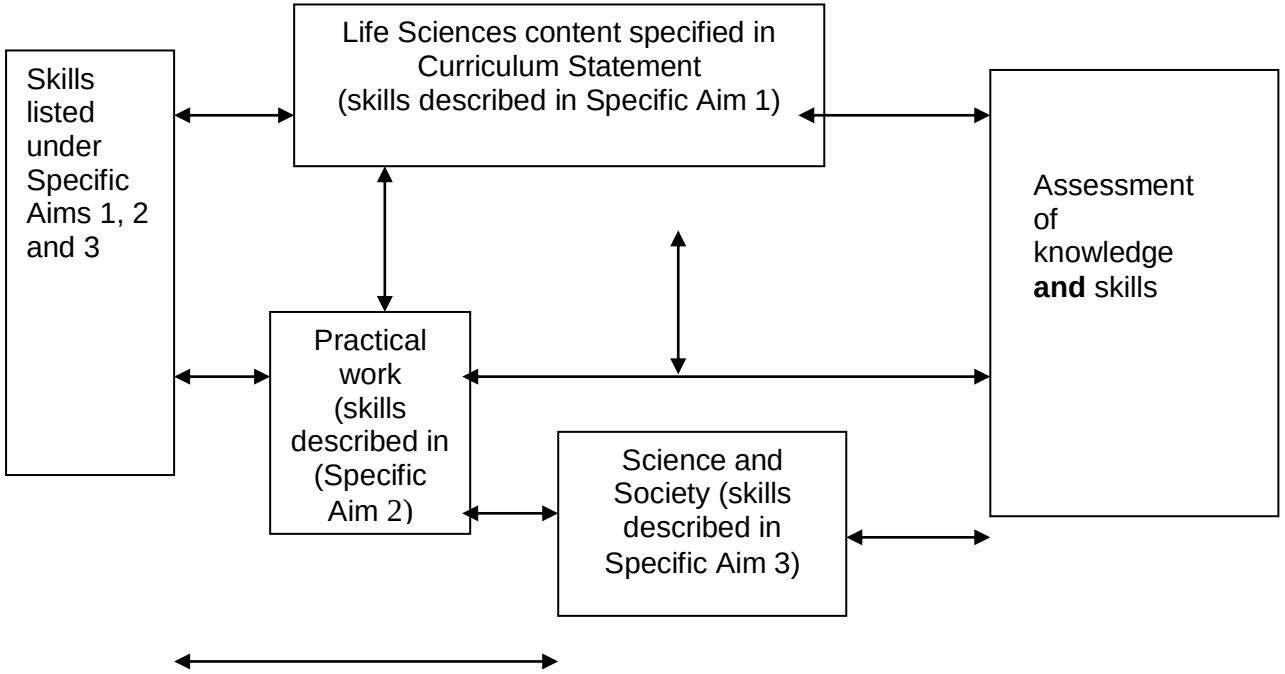
Learners must…

- **analyse** and **evaluate** the application of Life Sciences in everyday life (both positive and negative consequences)
- **analyse**, **discuss** and **debate** the ethical and legal issues related to biotechnology
- **explore** career opportunities in Life Sciences.

FLOW DIAGRAM: RELATIONSHIPS BETWEEN THE KEY CURRICULUM ELEMENTS

The following diagram illustrates how the three Learning Outcomes relate to the Specific Aims and to one another and how the ranges of skills must be infused into the subject content. The diagram:

- indicates how assessment relates to the content, the practical work, Science in Society, and the skills
- specifies what has to be taught (Specific Aims 1, 2 and 3) in which context
- states the skills to be taught and the assessments to be done.
- illustrates the infusion of skills in teaching and assessment activities.



TIME

The Grade 12 curriculum is taught over 29 of the 40 weeks of the school year. This leaves 11 weeks for tests and the three examinations and any other disruptions due to school activities. The time allocated per topic is a guideline only.

ASSESSMENT

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 decisions about the learning process.

Assessment should be mapped against the content, Specific Aims and Outcomes for Life Sciences.

Assessment should be both informal and formal and regular feedback should be provided to learners to enhance the learning experience. In all assessments it is important to:

- cover all of the subject content
- include the full range of skills
- use a variety of different forms or assessment.

Informal assessment

Regular assessments form part of the teaching and learning activities of the classroom.

Informal assessment can occur in every lesson, at any stage of the lesson. This can be done through questions and answers, class work (e.g. short pieces of written work completed during the lesson), open-book tests or homework exercises. These assessment activities should not be seen as separate from the learning activities in the classroom and should be used to provide feedback to learners to improve learning and teaching.

Informal assessments can be scored by teachers or learners. Self-assessment and peer assessment actively involves learners and allows them to learn from and reflect on their own performance. Learners may need assistance and encouragement to cope with their involvement in the scoring of assessments..

Informal, continuous assessment should be used to structure the acquisition of knowledge and skills and should be used as preparation for the formal tasks in the Programme of Assessment.

Informal assessments need not be recorded, unless the teacher wishes to do so. In such instances, a simple checklist may be used to record this assessment and to provide feedback.

The results of informal assessments do not have to be taken into account when determining a learner's final mark for promotion or certification purposes.

Formal assessment

Formal assessment provides teachers with a systematic way for reliably evaluating how well learners are progressing in a grade and a particular subject.

Formal assessment tasks are recorded and used to determine whether learners should be promoted to the next grade.

Teachers have to submit their annual formal Programme of Assessment to the School Management Team (SMT) before the start of the school year. This will be used to draw up a school assessment plan in each grade. The school assessment plan should be provided to learners and parents in the first week of the first term.

Examples of formal assessments include projects, oral presentations, practical tasks, class tests, examinations, etc. Possible projects for Life Sciences are suggested in the curriculum.

Formal assessments are part of the continuous programme of assessment in each grade and subject. Formal assessments are school-based and are weighted as follows for the different grades:

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 mid-year examinations)	75%
12	25% (including school-based examinations)	External examination: 75%

The cognitive demands of the assessment should be appropriate for the age and developmental level of the learners in the grade. The assessment tasks should be carefully designed to cover the content and the range of skills for Life Sciences. The design of these tasks should therefore ensure that all of the content and skills are assessed. Specific Aims, topics and content in the subject should be used to inform the planning and development of assessment tasks.

It is necessary to maintain a balance in respect of the cognitive demands when designing assessments for Grade 12. The following weightings apply to Life Sciences:

Assessment of content

Specific Aims 1.1 and 3.2 (knowing/remembering)	Specific Aims 1.2 and 3.1 (understanding/applying)	Specific Aims 1.3 and 3.3 (analysing, evaluating, creating)
40%	30%	30%

Teachers must ensure that this weighting is reflected in the design of individual assessments, e.g. class tests, worksheets, projects. If this requirement is met for every assessment, and there is evidence that the range is covered, then it will not be necessary to report again on each of these separately.
The requirements (number and nature of tasks) for Life Sciences are indicated below:

ASSESSMENT REQUIREMENTS FOR LIFE SCIENCES: GRADE: 12

<table>
<tr><th colspan="3">PROGRAMME OF FORMAL ASSESSMENT</th></tr>
<tr><td colspan="2">Formal recorded school-based assessments</td><td>End-of-year examinations</td></tr>
<tr><td>CONTENT</td><td>PRACTICAL</td><td>EXTERNAL EXAMINATION</td></tr>
<tr><td>• 6 tests (+1 in Term 4)
• 1 mid-year examination.
• 1 trial/preliminary examination
• 1 project (can be done in any term)</td><td>A selection of six representative practical tasks, which cover the specified range of skills, must be marked and recorded. (The marks allocated for practical tasks should range from 10 to 30)</td><td>• Written external examination (3hrs+1 hr)
• NOTE: suggested change
• Note: All of the content and skills should be examined, including knowledge of practical work as well as some of the skills associated with practical work.
• 3-hour examination paper which covers all of the content, concepts and skills specified in the Curriculum Statement for Grade 12 as well as environmental studies from the last term in Grade 11. A range of different question types must be used.
• 1-hour examination paper for which learners must prepare all of the content, concepts and skills.
Learners will have two options:
– an essay on any topic (select 1 from 3)
– three shorter paragraphs on any topics (select 3 from 5).</td></tr>
<tr><td colspan="2">School-based assessment (during the year) 25%</td><td>75</td></tr>
<tr><td colspan="2"></td><td></td></tr>
</table>

TERM 1	TERM 2	TERM 3	TERM 4	
• 2 tests • 1 selected practical task	• 2 tests • 2 selected practical tasks • Mid-year examination	• 1 test • 1 selected practical task • Poster presentation • Trial/ preliminary examination	• 1 test • 1 selected practical task	
33.3%	**33.3%**	**33.3%**	**N/a**	
Convert to 25%				**75%**

RECORDING

Recording is a process in which the teacher documents the level of a learner's performance. Teachers record the actual raw marks against the task using a record sheet.

Records of learner performance should also be used to verify the progress made by teachers and learners in the teaching and learning process. Records should be used to monitor learning and for future planning.

Possible template for recording of learner performance

Teachers may elect to adopt this template or they may wish to develop their own.
All formal tasks must be recorded (on a template). All conversions must be reflected.

Names	TERM 1			TERM MARK A		TERM 2					TERM MARK B		TERM 3				TERM MARK C	
	TEST 1	TEST 2	PRAC 1			TEST 3	TEST 4	PRAC 2	PRAC 3	EXAM			TEST 5	PRAC 4	POSTER	EXAM		
Max	60	50	30	140	%	60	60	25	30	300	475	%	60	30	20	300	410	%
1. Learner 1	41	35	21	97	69	39	43	18	24	208	332	70	44	25	17	212	298	73
2. Learner 2 etc.																		

The project can be completed in any term. Add the marks for the project in the term in which it is completed.

Calculating term marks

Example

Calculation of the **TERM MARK** for TERM 1:

Learner 1 gets the following marks:

- Test 1 : $^{41}/_{60}$
- Test 2 : $^{35}/_{50}$
- Prac 1 : $^{30}/_{21}$

The total for the term is $^{97}/_{140}$. This is 69 % ($^{97}/_{140}$ x $^{100}/_{1}$ = 69%)

This is the **TERM MARK for TERM 1 (at A). The learner qualified for rating code 5: Substantial Achievement.**

In the same way, calculate the term marks for each of **TERM 2 (70%) at B** and **TERM 3 (72%) at C**

Calculating the year mark

In Grade 12, the term marks for terms 1, 2 and 3 (including the preliminary exam) each count 33,3 % ($^{1}/_{3}$) of the **YEAR MARK,** i.e. they are weighted equally and the YEAR MARK counts 25% of the FINAL MARK. The **EXTERNAL NATIONAL SENIOR CERTIFICATION EXAM** counts for 75% of the **FINAL MARK.** These weightings are Departmental Policy.

Example

T1 (at A) + T 2 (at B) + T3 (at C)

69 + 70 + 73 = **70%** (or $^{211}/_{300}$ x $^{25}/_{1}$ = $^{18}/_{25}$**)**

Reporting

Reporting is a process of communicating learner performance to learners, parents, the school, districts and other stakeholders such as employers and tertiary institutions.

In Grades R -12, teachers report in percentages against the subject, using the following scale:

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.

TERM 1				
STRAND 1: life at 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, 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**.**				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
2 ½weeks (10 hrs)	**DNA: the code of life**	**DNA:** location in cell; chromosomes, genes and extranuclear DNA. • discovery of structure of DNA : Watson, Crick and Franklin • structure of DNA • role of DNA: genes and non-coding DNA • replication: cell cycle *(link to Grade 10)* • necessity for exact copy **RNA:** types, location in cells • structure of RNA • transcription from DNA • translation of RNA into protein (protein synthesis) (mRNA, tRNA): sequence of events • genetic code (basic understanding) • careers in Biochemistry, genetics, plant and animal husbandry, forensics	If possible: • simple process to extract DNA and examine the threads If possible: • DNA "finger printing" /DNA profiling	Textbook Micrographs Equipment Chemicals
1 week	**Meiosis**	**Meiosis:** reduction division		Textbook

(4 hrs)		• 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 different stages of meiotic cell division.	Posters Models Microscope Prepared microscope slides or micrographs .

STRAND 1: life at molecular, cellular and tissue level (continued)

and

STRAND 2: 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 2: 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	PRACTICAL WORK	RESOURCES
3 ½ weeks (14 hrs)	**Genetics and inheritance**	**Genes**: dominant, recessive, alleles 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, codominance. – **Dihybrid crosses**: phenotypes and genotypes – **Multiple alleles** – **Polygenic inheritance** – **Pleitropy** • **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 • Mitochondrial DNA: tracing genetic links	**Solving genetic problems** • Monohybrid crosses • Dihybrid crosses • Complete and incomplete dominance • Blood groups • Sex chromosomes and sexually linked diseases • Genetic lineages	Textbook Reference books

		• Paternity testing, DNA finger printing (forensics) • Careers in genetics, plant and animal breeding, stem cell research		

STRAND 3: life processes in plant and animals

In this knowledge strand, learners explore different reproductive strategies in animals. This links to the notion of species as genetically distinct groups which isolate themselves from other species at a variety of levels. Reproduction in humans is dealt with in more detail in Term 2 as a specific example of animal reproduction. This expands on the basic knowledge of human reproduction that was introduced in Grade 9.

TIME	TOPIC	CONTENT	PRACTICAL WORK	RESOURCES
1 week **(4hrs)**	**Reproduction in Vertebrates**	**Diversity of reproductive strategies** Appropriate examples of different groups in the animal kingdom to illustrate: – maximising reproductive success in different environments – reproductive isolation (concept of		Textbook Charts Reference books DVDs (if possible)

Total **8 weeks** **(32 hrs)**		species) through the following: • courtship behaviour • external or internal fertilisation • ovipary, ovovivipary, vivipary • amniotic egg • preccocial and altricial development • parental care		
ASSESSMENT	2 class tests, worksheets, homework, summaries, flow diagrams Refer to the range of skills specified in Specific Aims 1 and 3.		1 practical task - refer to the range of skills specified in Specific Aim 2.	

TERM 2				
STRAND 3: life processes in plants and animals (continued) This knowledge strand deals with the way in which plants and animals are able to respond to their environments in order to ensure their survival.				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
2 weeks **(8 hrs)**	**Human reproduction**	Revision of male and female reproductive systems: *(link to Grade 7 and Grade 9)* Unique human characteristics of some aspects of reproduction (*link with Grade 9)* • puberty • gametogenesis • menstrual cycle (emphasis on hormonal control) • fertilisation • gestation • role of placenta • development of young	Observe and draw or describe prepared microscope slides or micrographs or ultrasound pictures of embryonic development. Present a poster or write a report on the variety of contraceptive devices	Textbook Charts micrographs microscope prepared microscope slides Ultrasound pictures of embryonic development
1 ½ weeks **(6 hrs)**	**Responding to the environment: humans**	• **Two systems: nerves** and **hormones** enable animals to		Textbook Hand lens

		respond to the environment. • **Human nervous system:** reaction to stimuli in surroundings – **Central nervous system**: location and functions of cerebrum, cerebellum, medulla oblongata and 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 a generalised neuron – Simple explanation of transmission of nerve impulses: along neurons and across synapses – Reflex arc: structure, function and significance of a simple	Model of human brain: observe and draw	Scalpel or blade Dissecting board Models: eye ear brain charts

2 weeks **(8 hrs)**		reflex arc • **Disorders:** Alzheimer's, Attention Deficit Disorder • **Injuries:** brain and spinal damage • **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 only – Human eye: structure and function, binocular vision, accommodation, pupil reflex. Genetic diagram of colour blindness *(link to genetics)* – Short-sightedness, long-sightedness, astigmatism, cataracts – Human ear: structure and	• Investigation into reaction time to stimuli • Dissection of eye of sheep or pig. Observe and draw	Eye of sheep or pig obtained from butchery

		functions – Hearing defects: deafness, middle ear infections, grommets		
1 ½ weeks **(6 hrs)**	**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, growth hormone) *link to reproduction* – Thyroid gland (thyroxin) – Pancreas (insulin, glucagon) – Adrenal gland (adrenalin, aldosterone) – Gonads (oestrogen, progesterone, prolactin and testosterone) (*link to reproduction)* Negative feedback mechanisms: FSH, LH, oestrogen, progesterone *(link with human reproduction)* , TSH and thyroxin		Textbook Charts

		– Disorders of the endocrine glands		
1 weeks **(4 hrs)**	**Homeostasis in humans**	– **Homeostasis:** maintaining constant, optimal internal environment – **Negative feedback:** glucose, carbon dioxide *(links to Grade 10)*; water and salts (*links to Grade 11)* – **Thermoregulation:** adaptations of human skin; sweating, vasodilatation vasoconstriction	Observe and draw prepared microscope slide of section through human skin or use micrograph or model.	Textbook Microscope prepared slides or Micrographs or model
1 week **(4 hrs)** **Total** **9 weeks**	**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 Careers in plant, animal and human physiology,	Investigate geotropism and phototropism by controlling variables	Textbook Suitable equipment: geotropism and phototropism experiments

(36 hrs)		endocrinology, etc.		
ASSESSMENT		**2 class tests, worksheets, homework. Mid-year examination. Refer to the range of skills specified in Specific Aims 1 and 3.**	2 practical tasks. Refer to the range of skills specified in Specific Aim 2.	

TERM 3				
STRAND 2 : diversity, change and continuity (repeat): 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.				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
8 weeks (32 hrs)	**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 11),* genetics *(Grade 12)* and other forms of evidence – Difference between hypothesis and theory – Brief overview of history of different theories of development, e.g. spontaneous creation, Ontogeny, Lamarckism, Neo 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 species • **Formation/emergence of new species**: speciation, biological species	Class debate and discussion Demonstration of national 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)

Total 8 weeks (32 hrs)		concept, interbreeding produces viable offspring. ONE example of speciation due to geographic isolation (such as cichlid fish in Lake Malawi, Galapagos finches, mammals or plants on different landmasses, e.g. baobabs in Africa and Madagascar, proteas in South Africa and Australia) • **Mechanisms of reproductive isolation:** – breeding at different times of the year – species specific courtship behaviour (animals) – adaptation to different pollinators (plants) – incompatibility of external reproductive organs (animals) – mating – prevention of embryonic development – prevention of fertilisation – infertile offspring (animals and plants) • **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, HIV resistance to anti-retrovirals		
ASSESSMENT		1 class test, homework, worksheets, summaries, trial or preliminary examination (3hrs+1hr). Refer to the range of skills specified in Specific Aims 1 and 3	1 practical task (research). Refer to skills specified in Specific Aim 2	

TERM 4				
STRAND 2: diversity, change and continuity continued The knowledge strand is expanded in this term by exploring human evolution in Africa.				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
4 weeks **(16 hrs)**	**Human evolution**	• Evidence of common ancestors for living hominids including humans: – anatomical differences between African apes and humans – fossil evidence: key features: bipedalism (spine and pelvic girdle), brain size, teeth (dentition) and palate shape, brow ridge, the number of fossils that have been found – genetic evidence – 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: Johansen and White, the Leaky family – **Main fossil sites in South Africa e.g.** Cradle of Humankind (Sterkfontein, Kromdraai, Driemolen, Plovers Lake, Gladysvale etc), Makapansgat, Florisbad, Border Cave, Langebaan, Klasies River. Evidence from these sites. Evolutionary trends. (*Refer to dating of fossils Grade 10):* Scientists such as Dart, Broome, Tobias, Brain, Clark, Berger, Keyser**.** • **Importance of the Cradle of Humankind**	**Poster presentation** Map out the three major phases in hominid evolution from 6 mya to the present: Ardipithecus, Australopithecus and Homo. The map/timeline should show the approximate times that examples of the three major genera existed. It is not necessary to show the relationships between the genera. (Scientists may interpret the relationships differently as new evidence is found.) or 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**.**	Textbook Newspaper articles (e.g. the discovery of sediba) DVDs if possible Maps, pictures, photographs

Total **4 weeks** **(16 hrs)**		• Different cultural and religious explanations for the origin and development of life on earth. Cultural, religious and scientific explanations are valid for their particular contexts (multiple realities). • Careers in paleoanthropology	Research and discussion to share information about different explanations	
ASSESSMENT		1 class test, worksheets, end-of-year examination (3hrs+ 1hr) (National Senior Certificate). Refer to range of skills specified in Specific Aims 1 and 3.	1 Research: poster presentation. Refer to range of skills specified in Specific Aim 2.	