basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

CURRICULUM AND ASSESSMENT POLICY STATEMENT

(CAPS)

NATURAL SCIENCES

FINAL DRAFT

SECTION 1

NATIONAL CURRICULUM AND ASSESSMENT POLICY STATEMENT FOR NATURAL 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Statements, Learning Programme Guidelines and Subject Assessment Guidelines for Grades R - 9 and Grades 10 - 12 are repealed and replaced by the *Curriculum and Assessment Policy documents for Grades R – 12 (January 2011)*.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.

SECTION 2

CURRICULUM AND ASSESSMENT POLICY STATEMENT: NATURAL SCIENCES

GRADE 7

INTRODUCTION

Natural Sciences in the Senior Phase is compulsory for all learners. It is therefore critical in promoting and developing scientific literacy, as learners may elect not to continue with one of the science subjects beyond Grade 9. Natural Sciences serves a dual purpose: it must enable learners to make sense of the world in scientific terms and prepare learners for continuing with a science(s) into the FET phase…and beyond.

In the Natural Sciences Curriculum, four "Knowledge Areas" are used as organisers for the Physical Sciences, Life Sciences and Earth Sciences elements of the subject. They are intended to serve as a broad introduction to the specialisations (and the Knowledge Strands) of sciences in the Further Education and Training Phase.

Each Knowledge Area is developed progressively across the three years of the Senior Phase. The Knowledge Areas are:

- Life and Living (which leads on to the Knowledge Strands for Life Sciences in FET).
- Matter and Materials (which leads on to the Knowledge Strands for Physical Sciences in FET).
- Energy and Change (which leads on to Knowledge Strands in both Life Sciences and Physical Sciences).
- Earth and Beyond (which leads on to Knowledge Strands in both Life Sciences and Geography).

The Knowledge Areas are a tool for organising the subject content. When teaching Natural Sciences, it is important to emphasise the links learners need to make with related topics to help them achieve a thorough understanding of the nature of and connectedness in the sciences. Links must also be made progressively across grades to all four Knowledge Areas.

The Knowledge Areas focus on the ideas, skills, concepts and connections between them, rather than a listing of the facts and procedures that need to be learned. They do not prescribe particular instructional strategies or methodologies. Teachers have the freedom to expand concepts and to design and organise learning experiences according to their local circumstances.

The cognitive and practical skills that have been identified must be taught, and assessed, in an integrated way (and **at the appropriate grade level**) in the context provided by the four Knowledge Areas.

The recommended sequence for the teaching of the four Knowledge Areas in this document for Grade 7 is:

1. Matter and Materials (Area 1)
2. Energy and Change (Area 2)
3. Earth and Beyond (Area 3)
4. Life and Living (Area 4)

However, teachers should decide the sequence in a particular term. In Grade 7, learners are expected to carry out their own investigations to expand on the concepts or knowledge to which they have been introduced and to deepen their understanding of the subject matter.

The first section in Grade 7, called "Subject Orientation", is included to prepare learners for the Senior Phase, and is intended to

- familiarise learners with the way the teacher will organise learning activities.
- familiarise learners with the behaviour that will be required and rules for safety.
- connect what learners have learned in the Intermediate Phase with what they will learn, and the skills that they must develop, in the Senior Phase.
- describe how knowledge is constructed in Science and to introduce a scientific approach that both teachers and learners are required to use when teaching and learning Natural Sciences.
- introduce learners to some basic principles related to science.
- familiarise learners with the skills that they must acquire.

This 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 Natural Sciences. These are

1. Specific Aim 1, which relates to the knowledge or content (theory).
2. Specific Aim 2, which relates to doing science or practical work.
3. Specific Aim 3, which relates to understanding the applications of Natural Science 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 competences have been identified. It is not advisable to try to assess each of the skills separately, nor is it possible to report on individual skills separately. However, **well designed assessments** must show **evidence** that, by the end of the year, all of the skills have been assessed **at a grade-appropriate level**. There must be a clear link between the aims and the outcomes of learning. The assessments are the link.

Whilst learner performance can be reported on separately for Specific Aims 1 (knowing) and 2 (doing), 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 NATURAL SCIENCES (of Natural Sciences concepts, processes, phenomena, mechanisms, principles, theories, laws, models, etcetera)

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

1.1 ACQUIRE KNOWLEDGE

Skills

Learners must…

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

Assessments

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

1.2 UNDERSTAND AND MAKE MEANING OF NATURAL SCIENCES

Skills

Learners must…

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

Assessments

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

1.3 APPLY KNOWLEDGE OF NATURAL SCIENCES IN NEW AND UNFAMILIAR CONTEXTS

Skills

Learners must…

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

Assessment

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

2. SPECIFIC AIM 2: INVESTIGATING PHENOMENA IN NATURAL SCIENCES

The following range of skills relate to doing practical work in Natural Sciences. All seven skills will not apply to every practical activity equally. The skills are aligned to what learners would be doing in the normal course of doing practical work. Teachers must select those that apply to, and which can be assessed in, the context of specific activities. By the end of the Grade 7 year, **at least** the first six skills must have been assessed at a **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 OR APPARATUS

This should include knowledge of the apparatus, that is, naming it and knowing what it is used for. It includes a variety of different kinds of equipment. "Handling equipment" is a generic skill and would apply to any equipment used for many different kinds of investigation. Handling improvised equipment requires the same skills as would be required for handling standard laboratory equipment.

2.3. MAKE OBSERVATIONS

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

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

2.4. RECORD INFORMATION OR DATA

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

2.5. MEASURE

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

2.6. INTERPRET

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

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

2.7. DESIGN/PLAN INVESTIGATIONS OR EXPERIMENTS

Not all investigations are based on the "classic" dependent-independent variables and controls. For example, an investigation could

involve observing soil profiles or counting populations.

Also, designing an investigation is a different process from planning an investigation.

Skills include:

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

In Grade 7, learners must be assisted to plan and/or design a simple investigation or 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 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 Natural Sciences, including simple investigations or experiments. This approach makes it easier to assess learners in a range of different circumstances and it enables a teacher to judge a learner's ability to **do** science. The skills are based on what learners would do in the normal course of doing practical work. However, there are some circumstances in which only some of these skills would apply and not every skill can be assessed in every practical task.

3. SPECIFIC AIM 3: APPRECIATING AND UNDERSTANDING THE IMPORTANCE AND APPLICATIONS OF NATURAL 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 or importance of these specific discoveries for society.

As far as possible, these aspects should be linked to and taught with topics and content that are relevant to a discovery or a scientist.

3.2 RELATIONSHIP OF INDIGENOUS KNOWLEDGE TO NATURAL SCIENCES

Note: Examples that are selected (and that should, as far as possible, reflect different South African cultural groupings) **will** also link directly to specific areas in the Natural Sciences subject content.

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

This is about the applications and relevance, that knowledge of Natural Sciences has found in various aspects of society. Examples should be relevant to the subject content that learners are dealing with at a particular time. For example, there are career opportunities in respect of socio-biology and animal behaviour, plant pathology, game management, environmental impact studies, preservation of biodiversity, palaeontology, paleoanthropology, agriculture, horticulture, environmental law, science journalism, biotechnology and genetic engineering, and many others. Examples of some of the possibilities are included in the appropriate topics. Learners should be made aware of careers, but these should not be discussed or taught in great detail.

Skills

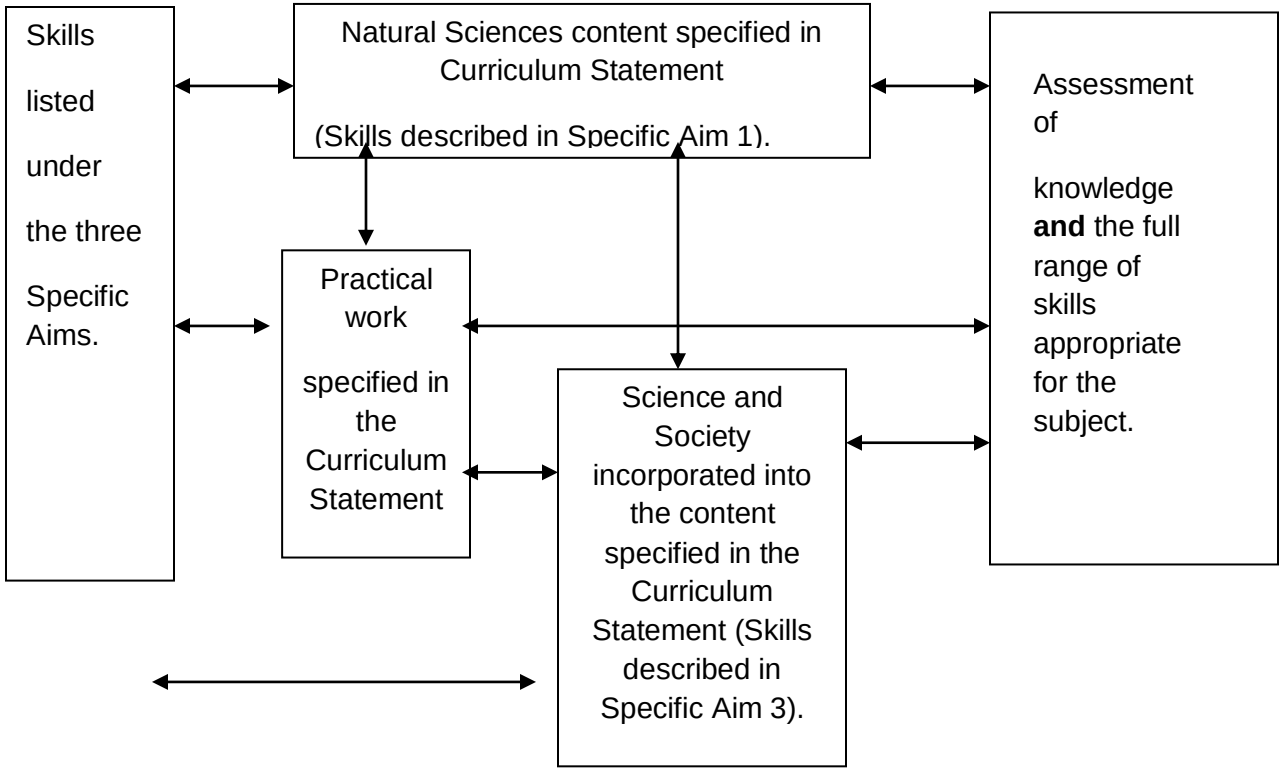
Learners must…

- **analyse** and **evaluate** the application of Natural Sciences in everyday life (both positive and negative consequences).
- **analyse**, **discuss** and **debate** the ethical and legal issues.
- **become** aware of some career opportunities in Natural 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, practical work, Science and Society, as well as 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 7 has been designed to be completed within 31½ weeks out of 40 weeks in the school year. This leaves 8½ 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. In Grade 7, a significant amount of time should be spent on doing practical tasks and investigations.

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

Assessment should be mapped against the content and intended aims specified for Natural 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 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 by asking questions and giving answers, class work, such as short pieces of written work completed during the lesson, open-book tests, worksheets or homework exercises, etcetera. 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 involve learners in assessment and allow learners to learn from and reflect on their own performance. In the Senior Phase, learners should be guided and assisted with self- and/or peer assessment.

Informal, ongoing assessments should be used to scaffold the acquisition of knowledge and skills and should be the stepping stones leading up to the formal tasks in the Programmes 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 that are used for formal assessment are recorded and are used to determine whether a learner should progress or 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 for 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, etcetera. For Natural Sciences, possible projects are suggested in 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%	75%
12	25% including school-based mid-year examinations and "trial" examinations	External examination: 75%

The cognitive demands of assessment used 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 that have been specified under the Specific Aims. The design of these tasks should therefore ensure that a variety of content and skills is assessed. Aims, topics and content in the subject should be used to inform the planning and development of assessment tasks.

Formal assessments in Natural 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%

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

ASSESSMENT REQUIREMENTS FOR NATURAL SCIENCES: GRADE: 7

<table>
<tr><td colspan="5">PROGRAMME OF FORMAL ASSESSMENT</td></tr>
<tr><td colspan="4">FORMAL, RECORDED SCHOOL-BASED ASSESSMENTS 40%</td><td>END-OF-YEAR INTERNAL EXAMINATION 60%</td></tr>
<tr><td colspan="2">CONTENT</td><td colspan="2">PRACTICAL</td><td>WRITTEN EXAMINATION (1hour)</td></tr>
<tr><td colspan="2">• Four formal class tests
• One mid-year examination
• One project (can be done in any term)</td><td colspan="2">A selection of eight representative practical tasks, which cover the range of skills, must be marked and recorded.

The marks allocated for practical tasks should range between 15 and 30.</td><td>Content, concepts, skills across all topics, including knowledge of practical work and some of the skills associated with practical work, must be assessed in the exam.</td></tr>
<tr><td colspan="4">SCHOOL-BASED ASSESSMENT (During the year)</td><td></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>• One formal class test.
• Two selected practical tasks</td><td>• One formal class test.
• Two selected practical tasks
• One mid-year examination (1 hour)</td><td>• One formal class test
• Two selected practical tasks</td><td>• One formal class test
• Two selected practical tasks</td></tr>
<tr><td>25%</td><td>25%</td><td>25%</td><td>25%</td></tr>
<tr><td colspan="4">Convert to 40% (YEAR MARK)</td><td>60% (EXAM MARK)</td></tr>
</table>

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

RECORDING

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 a different template). All conversions must be reflected.

Note: The marks for the project must be added in to any of the four terms, that is, the term in which the project was completed.

Names	TERM 1			TERM MARK A		TERM 2				TERM MARK B		TERM 3			TERM MARK C		TERM 4			TERM MARK D	
	TEST 1	PRAC 1	PRAC 2			TEST 2	PRAC 3	PRAC 4	EXAM			TEST 3	PRAC 5	PRAC 6			TEST 4	PRAC 7	PRAC 8		
Max	50	20	30	95	%	50	15	25	100	190	%	50	20	20	90	%	50	25	15	90	%
1. Learner 1	34	17	20	66	69	29	7	19	62	117	62	37	16	14	67	74	39	20	8	67	74
2. Learner 2 etcetera.																					

CALCULATING TERM MARKS

Example

In order to calculate the **TERM MARKS** for **TERM 1:**

Learner 1 gets the following marks:

Test 1: $^{34}/_{50}$

Practical 1: $^{17}/_{20}$

Practical 2: $^{15}/_{25}$

Total for term: $^{66}/_{95}$

This is 69% ($^{66}/_{95}$ x [ ] = 69%).

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

The learner gets a rating code of 6: meritorious achievement.

In the same way, calculate the term marks for each of **TERM 2 (62%) at B, TERM 3 (74%) at C and TERM 4 (74%) at D.**

END-OF-YEAR EXAMINATION

NAMES	EXAMINATION		CONVERSION E
MAX	80	%	60
1. Learner 1	63	79	47
2. Learner 2 etcetera.			

CALCULATING THE EXAM MARKS

- The marks for the examination count 60% or 60 marks out of a 100 of the **FINAL MARK**. This is departmental policy.
- The marks for the written, end-of-year exam must therefore be converted to a mark out of 60.

For example

- Learner 1 gets 63 marks out of 80 for the examination.
  - [ ] is equal to 79% ([ ] x [ ] = 79%).
  - Conversion of mark

    [ ] x [ ] = 47 marks out of 60 at E **EXAM MARK**

FINAL MARK

- In Grade 7, the term marks for terms 1, 2, 3 and 4 **each** count 25% (¼) of the **YEAR MARK,** that is, they are weighted equally.
- The **YEAR MARK** counts 40% of the FINAL MARK. This is departmental policy.
- The **YEAR MARK** therefore needs to be converted to a mark out of **40.**

For example:

- First convert the total of the four term marks (A,B,C,D) to a mark out of 40:
  T 1 (A) + T 2 (B) + T 3 (C) + T 4 (D)

  69% + 62% + 74% + 74% = [ ] x [ ] = **28 marks out of the 40 (F) (YEAR MARK)**

- Lastly, add the **YEAR MARK (F)** out of 40 to the **EXAM MARK (E)** out of 60.
  28 (F) + 47 (E) = 75 out of 100 **FINAL MARK (75%)**

NAMES	**YEAR MARK F**	**EXAM MARK E**	**FINAL MARK**
MAX	40	60	100
1. Learner 1	28	47	75
2. Learner 2 etc.			

Learner 1 therefore gets 75%, which is 6 on the rating scale: meritorious achievement.

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.

Reporting

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

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

Codes and percentages for reporting in Grades R to 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.

NATURAL SCIENCES: GRADE 7

TERM 1	
TIME	**INTRODUCTION TO NATURAL SCIENCES: SUBJECT ORIENTATION**
½ Week **(1½ hours)**	• Establish links between Natural Sciences and Life Sciences, Physical Sciences and Geography in the FET phase. • Nature of Science: contested knowledge, non-dogmatic, inferences based on evidence, peer review. • **How science works:** All of the following should be explained in simple terms: – Fundamental knowledge built on scientific evidence and verifying findings. – Observing. – Investigating. – Collecting and presenting data/information. – Identifying patterns and relationships in data. – Communicating findings. – Limitations of scientific evidence. – Beginning to understand variables. • **Scientific skills:** – Biological drawings and science diagrams. – Interpreting two-dimensional drawings as three-dimensional objects: transverse and longitudinal sections. – Understanding symmetries. – Introduction to graphs, interpreting graphs. – Overview of the skills listed in the Specific Aims. • **Class organisation and rules** – Using equipment and other resources. – Safety procedures. – Working in groups. – Assessment requirements. **Note**: This introduction must not be assessed. The topics covered in the introduction will be assessed in the context of the specific content where they apply.

TERM 1				
AREA 1: MATTER AND MATERIALS				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
8 weeks (24hours)	**Properties of materials**	• **Properties and uses of matter and materials.** – Factors which determine suitability of materials for specific uses: strength, flexibility, mass, boiling and melting points, conductivity. • Materials produced in local industries: their uses *(links to Grades 8, 9*). (Note: "Local industries" not only refer to factories, mills, etcetera, as there is a wealth of materials used in "local industry" also in rural areas, for instance: in building technologies, baskets, utensils, clothing, etcetera). • Impact on the environment of the production and use of the materials: environmental damage caused by accessing the materials, their use, waste products and pollution. • **Properties of a mixture:** physical methods of separation: hand sorting, magnetism, flotation, sieving and filtration, evaporation, distillation, chromatography. • Separation methods: problems of recycling waste materials. • Careers in which knowledge of materials is important, for instance building, engineering, electronics, etcetera.	• Design simple tests to examine and compare properties of selected materials to determine: strength, flexibility, mass, boiling and melting points. (Note: Materials commonly used locally should be the focus of the investigations and will be different in heavily industralised, urban, semi-urban and rural areas.) • Test how well separation techniques work. Record observations and report on which methods work for which mixtures. • Investigate the purification of dirty water using some of the methods for separating mixtures. Evaluate the efficiency of these methods.	Textbook. Selection of materials, for instance paper copper wire wood rubber plastic stone aluminium, etcetera. Heat source. Thermometer. Wax or Vaseline.

ASSESSMENT	One formal class test, homework, worksheets. Refer to the range of skills specified under Specific Aims 1 and 3.	Two elected practical tasks Refer to range of skills specified under Specific Aim 2.	

TERM 2				
AREA 2: ENERGY AND CHANGE:				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
7 weeks **(21 hours)**	**Energy transfers**	• Kinetic and potential energy within a system. • Energy transfers: in chemical, electrical, mechanical systems. • Energy transfers associated with heating and cooling: conduction, convection, radiation, evaporation, condensation. • Thermal conductors and insulators. • Reflectors: efficient and poor reflectors. • Chain of energy transfers in providing energy to the community: from the energy source to the end point where it is consumed. • Energy conservation: designs that save energy, for instance solar water heater or "wonder box" for cooking. Principles involved in reducing heat loss through conduction, convection and radiation or increasing heat gain. • Environmental impact of the use of energy resources. • Renewable and non-renewable energy resources:	• Investigate the thermal and electrical conduction and insulation properties of a selection of metals. • Investigate energy efficiency in the classroom with regard to either heat loss or heat gain by conduction, convection and radiation. Investigate and suggest ways in which the energy efficiency could be improved in the classroom or in the home. • Construct a small solar water heater or "wonder box". Explain how the materials used in the system contribute to its efficiency. (Learners could work in groups.) • Survey to investigate the cost of using different sources of energy for cooking: wood, paraffin, electricity. • Collect information on the sources of energy in the national electricity supply system.	Textbook. Selection of materials. Heat sources. Selection of materials needed to construct a small energy-saving device. Newspapers.
ASSESSMENT		One formal class test, homework, worksheets, mid-year examination (1	Two selected practical tasks.	

	hour). Refer to the range of the skills specified under specific Aims 1 and 3.	Refer to the range of skills specified under Specific Aim 2.	

TERM 3				
AREA 3: EARTH AND BEYOND				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
8 weeks (24 hours)	**Earth: solar system to fossils**	• Earth in the solar system: sun, planets, moons: regular and predictable motions. • Structure of the earth: core, mantle and crust, magnetic field, atmosphere. • Sun: source of energy, seasons. • Weather: temperature, rainfall, wind speed and direction, cloud cover. • Technological advances: satellites and weather forecasting. • Weather forecasting in different cultures. • Energy flow through the ecosystem: food chains and food webs: Importance of dead plants and animals. (*No detail required. The purpose is to create the link between energy from the sun and the origins of fossil fuels.)* • Fossil fuels: origins. • Fossils: What are fossils? • Extinct species in South Africa. • Importance of South Africa: human origins. Fossil evidence from the Cradle of Humankind. *(No detail required.)* • Careers in conservation, paleoanthropology, weather forecasting, etcetera.	• Model or draw a diagram of the solar system: positions and relative sizes of the sun and planets. • Investigate a local ecosystem to identify food chains and a food web. Record observations as flow diagrams. • Devise ways of measuring temperature, rainfall, wind speed and direction, cloud cover, sunshine. • Record observations. • Research the history of one endangered animal in South Africa. • Research one extinct species in South Africa.	Text book. Thermometer. Rain gauge. Wind sock or flag. Compass. Field guides. Keys. Magazines. Television. Internet.
ASSESSMENT		One formal class test, homework, worksheets. Refer to the range of skills specified under Specific Aims 1 and 3.	Two practical tasks. Refer to the range of skills specified under Specific Aim 2.	

TERM 4				
AREA 4: LIFE AND LIVING				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
8 weeks **(24 hours)**	**Puberty and reproduction**	• Sexual reproduction in humans: reproductive organs – Puberty: psychological and emotional changes. – Menstruation and fertile stages. – Sex and conception. – Pregnancy. – Contraception. – Sexually transmitted diseases (STDs) including HIV/AIDS. – Myths about sex. • Inherited characteristics among family members: variation. • Variation: similarities and differences. • Concept of classification system: – Vertebrate and invertebrate classification: diagnostic characteristics of five vertebrate and three invertebrate (including insects), phyla.	• Research decisions about responsible sexual behaviour. Present findings as a written report. • Collect data on the height of learners in the class. Present data as an appropriate graph. Analyse and compare the height of boys and girls. • Identify variations, in respect of tongue rolling, in the class and in the family. Determine the differences between the two groups. Make inferences about inherited traits. • Group a selection of everyday objects according to observable features, for instance shape, colour, size, etcetera. Construct a simple classification diagram. • Collect fruits and seeds, observe and record structure, make inferences about methods of dispersal.	Text book. Collection of objects. Identification guides. Keys. Yardstick, measuring tape or ruler. Photographs or pictures. Charts.

Total: 31 weeks (93 hours)	**Diversity, change and continuity**	– Reproduction and life cycle of an insect (metamorphosis). – Seed-bearing and non-seed-bearing plants. – Fruits and seeds: various methods for dispersal. – Asexual, vegetative reproduction in plants.		
ASSESSMENT		One formal class test, worksheets, homework. One end-of-year exam (1hour) Refer to the range of skills specified under Specific Aims 1 and 3.	Two practical tasks. Refer to the range of skills specified under Specific Aim 2.	

GRADE 8

INTRODUCTION

Natural Sciences in the Senior Phase is compulsory for all learners. It is therefore critical in promoting and developing scientific literacy, as learners may elect not to continue with one of the science subjects beyond Grade 9. Natural Sciences therefore serves a dual purpose: it must enable learners to make sense of the world in scientific terms and prepare learners for continuing with a science(s) into the Further Education and Training (FET) phase … and beyond.

In the Natural Sciences Curriculum, four "Knowledge Areas" are used as organisers for the Physical Sciences, Life Sciences and Earth Sciences elements of the subject. They are intended to serve as a broad introduction to the specialisations (and the Knowledge Strands) of sciences in the FET phase.

Each Knowledge Area is developed progressively across the three years of the Senior Phase. The Knowledge Areas are:

- Life and Living (which leads on to the Knowledge Areas for Life Sciences in FET).
- Matter and Materials (which leads up to the Knowledge Areas for Physical Sciences in FET).
- Energy and Change (which leads up to Knowledge Areas in both Life Sciences and Physical Sciences).
- Earth and Beyond (which leads up to Knowledge Areas in both Life Sciences and Geography).

Neither the Knowledge Areas nor the topics within each Knowledge Area should be treated separately or independently. They are simply a tool for organising the subject content. When teaching Natural Sciences, it is important to emphasise the links that learners need to make with related topics to help them achieve a thorough understanding of the nature of and connectedness between the sciences. These links must also be made progressively across grades.

The Knowledge Areas focus on the ideas, skills, concepts and connections between them, rather than a listing of the facts and procedures that need to be learned. They do not prescribe particular instructional strategies or methodologies. Teachers have the freedom to expand concepts and to design and organise learning experiences according to their local circumstances.

The cognitive and practical skills that have been identified must be taught, and assessed, in an integrated way (and at the **appropriate grade level**) in the context provided by the four Knowledge Areas.

The recommended sequence for the teaching of the four Knowledge Areas in this document for Grade 8 is:

5. Earth and Beyond (Area 1)
6. Life and Living (Area 2)
7. Matter and Materials (Area 3)
8. Energy and Change (Area 4)

However, teachers should determine the sequence (in a particular term). In Grade 8, learners are expected to carry out their own investigations, to expand concepts they have been introduced to and to deepen their knowledge.

The first section in Grade 8, called "Subject Orientation", is included to prepare learners for the first year in high school (which may be different from the organisation in Grade 7) and aims to

- familiarise learners with the way the teacher will organise learning activities.
- familiarise learners with the behaviour that will be required and rules for safety.
- connect what learners have learned in Grade 7 with what they will learn, and the skills they must develop, in the rest of the Senior Phase (Grades 8 and 9).
- describe how knowledge is constructed in Science and to introduce a scientific approach that both teachers and learners are required to use when teaching and learning Natural Sciences.
- introduce learners to some basic principles related to science.
- familiarise learners with the skills they must acquire.

This 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 Natural Sciences. These are

4. Specific Aim 1, which relates to the knowledge or content (theory).
5. Specific Aim 2, which relates to doing science or practical work.
6. Specific Aim 3, which relates to understanding the applications of Natural Science 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 competences have been identified. It is not advisable to try to assess each of the skills

separately, nor is it possible to report on individual skills separately. However, **well designed assessments** must show **evidence** that, by the end of the year, all of these skills have been assessed **at a grade-appropriate level**. 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) in respect of 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 NATURAL SCIENCES (of Natural Sciences concepts, processes, phenomena, mechanisms, principles, theories, laws, models, etcetera)

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

1.4 ACQUIRE KNOWLEDGE

Skills

Learners must…

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

Assessments

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

1.5 UNDERSTAND AND MAKE MEANING OF NATURAL SCIENCES

Skills

Learners must…

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

Assessments

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

1.6 APPLY KNOWLEDGE OF NATURAL SCIENCES IN NEW AND UNFAMILIAR CONTEXTS

Skills

Learners must…

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

Assessment

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

4. SPECIFIC AIM 2: INVESTIGATING PHENOMENA IN NATURAL SCIENCES

The following range of skills relate to doing practical work in Natural 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 those that apply to, and which can be assessed in, the context of specific activities. By the end of the Grade 8 year, at least the first six skills must have been assessed at a **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 OR APPARATUS

This should include knowledge of the apparatus, that is, naming it and knowing what it is used for. It includes a variety of different kinds of equipment. "Handling equipment" is a generic skill and would apply to any equipment used for many different kinds of investigation.

Handling improvised equipment requires the same skills as would be required for handling standard laboratory equipment.

2.3. MAKE OBSERVATIONS

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

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

2.4. RECORD INFORMATION OR DATA

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

2.5. MEASURE

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

2.6. INTERPRET

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

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

2.7. DESIGN OR PLAN INVESTIGATIONS OR EXPERIMENTS

Not all investigations are based on the "classic" dependent-independent variables and controls. For example, an investigation could

look at observing soil profiles or counting populations.

Also, designing an investigation is a different process from planning an investigation.

Skills include:

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

In Grade 8, learners must be assisted to plan and/or design a simple investigation or 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 one form or another, in order to carry out an experiment or investigation. By separating seven different kinds of skill (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 Natural Sciences, including simple investigations or experiments. This approach makes it easier to assess learners in a range of different circumstances and enables a teacher to judge a learner's ability to **do** science. The skills are based on what learners would do in the normal course of doing practical work. However, in some circumstances only some of these skills would apply and not every skill can be assessed in every practical task.

5. SPECIFIC AIM 3: APPRECIATING AND UNDERSTANDING THE IMPORTANCE AND APPLICATIONS OF NATURAL 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 or importance of these specific discoveries for society.

As far as possible, these aspects should be linked to and taught with topics and content that are relevant to a discovery or a scientist.

3.2 RELATIONSHIP OF INDIGENOUS KNOWLEDGE TO NATURAL SCIENCES

Note: Examples that are selected (and that should, as far as possible, reflect different South African cultural groupings) **will** also link directly to specific areas in the Natural Sciences subject content.

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

This is about the applications, and relevance, that knowledge of Natural 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, career opportunities exist in respect of socio-biology and animal behaviour, plant pathology, game management, environmental impact studies, preservation of biodiversity, palaeontology, paleoanthropology, agriculture, horticulture, environmental law, science journalism, biotechnology and genetic engineering, and many others. Examples of some of the possibilities are included in the appropriate topics. Learners should be made aware of careers, but these should not be discussed or taught in great detail.

Skills

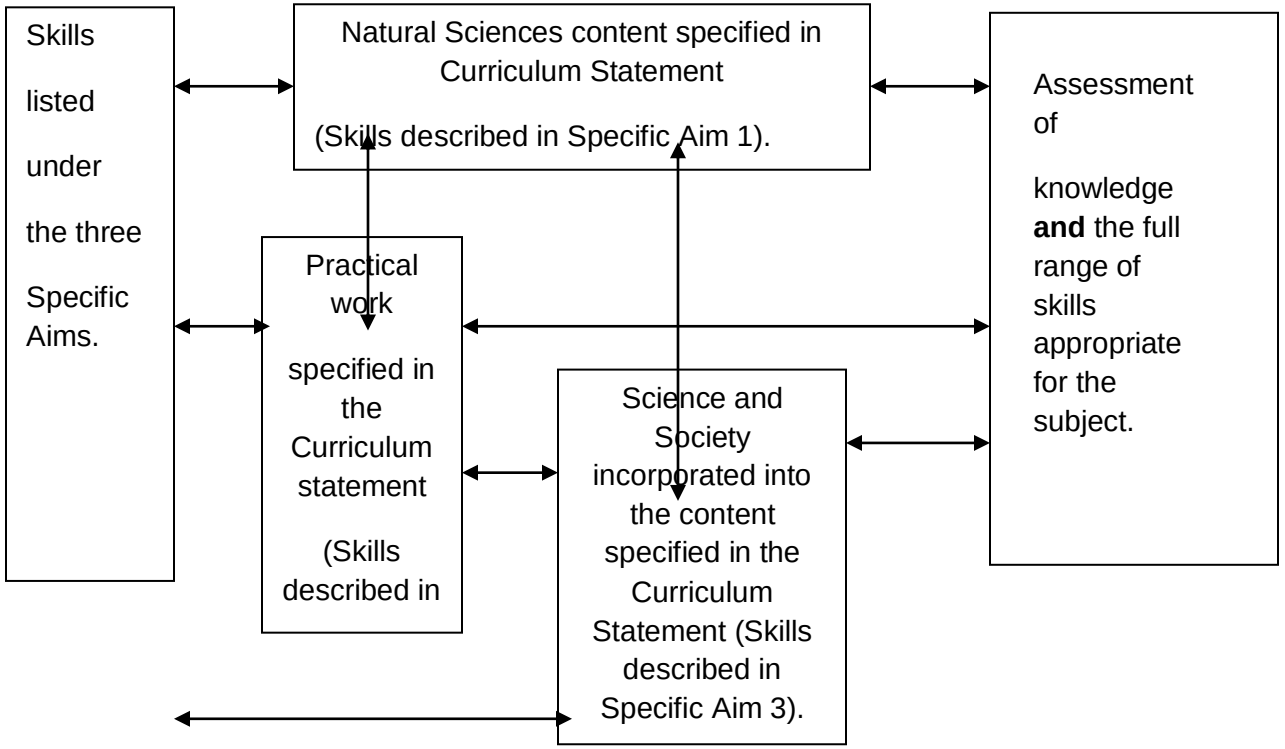
Learners must…

- **analyse** and **evaluate** the application of Natural Sciences in everyday life (both positive and negative consequences).
- **analyse**, **discuss** and **debate** the ethical and legal issues.
- **become** aware of some career opportunities in Natural 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, practical work, Science and Society, as well as 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 8 has been designed to be completed within 31 weeks out of 40 weeks in the school year. This leaves nine 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. In Grade 8, a significant amount of time should be spent on practical tasks and investigations.

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 learners.

Assessment should be mapped against the content and intended aims specified for Natural 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 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 by asking questions and providing answers, class work, such as short pieces of written work completed during the lesson, open-book tests, worksheets or homework

exercises, etcetera. 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 involve learners in assessment and allow learners to learn from and reflect on their own performance. In the Senior Phase, learners should be guided and assisted with self- and/or peer assessment.

Informal, ongoing assessments should be used to scaffold the acquisition of knowledge and skills and should be the stepping stones leading up to the formal tasks in the Programmes 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 that are used for formal assessment are recorded and used to determine whether a learner should progress or 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 for 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, etcetera. For Natural Sciences, possible projects are suggested in 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%	75%
12	25% including school-based mid-year examinations and "trial" examinations.	External examination: 75%

The cognitive demands of assessment used 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 that have been specified under the Specific Aims. The design of these tasks should therefore ensure that a variety of content and skills is assessed. Aims, topics and content in the subject should be used to inform the planning and development of assessment tasks.

Formal assessments in Natural 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 **design** assessments to reflect this weighting. If there is evidence of this weighting in the assessment, it is not necessary to report on each one separately.

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

ASSESSMENT REQUIREMENTS FOR NATURAL SCIENCES: GRADE: 8

<table>
<tr><td colspan="5">PROGRAMME OF FORMAL ASSESSMENT</td></tr>
<tr><td colspan="3">FORMAL, RECORDED SCHOOL-BASED ASSESSMENTS 40%</td><td colspan="2">END-OF-YEAR INTERNAL EXAMINATION 60%</td></tr>
<tr><td colspan="2">CONTENT</td><td>PRACTICAL</td><td colspan="2">WRITTEN EXAMINATION (1½hrs)</td></tr>
<tr><td colspan="2">• Four formal class tests
• One mid-year examination
• One project (can be done in any term)</td><td>A selection of eight representative practical tasks, which cover the range of skills, must be marked and recorded. The marks for practical tasks should range between 10 and 30.</td><td colspan="2">Content, concepts, skills across all topics, including knowledge of practical work and skills associated with practical work, must be assessed in the written exam.</td></tr>
<tr><td colspan="3">SCHOOL-BASED ASSESSMENT (During the year)</td><td colspan="2"></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></td><td></td><td></td><td></td></tr>
<tr><td>• One formal class test.
• Two selected practical tasks.</td><td>• One formal class test.
• Two selected practical tasks.
• One mid-year examination (1½ hours).</td><td>• One formal class test.
• Two selected practical tasks.</td><td>• One formal class test.
• Two selected practical tasks.</td></tr>
<tr><td>25%</td><td>25%</td><td>25%</td><td>25%</td><td></td></tr>
<tr><td colspan="3">Convert to 40% (YEAR MARK)</td><td colspan="2">60% (EXAM MARK)</td></tr>
</table>

RECORDING

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 a different template). All conversions must be reflected.

Note: The marks for the project must be added in to any of the four terms, that is, the term in which the project was completed.

Names	TERM 1			TERM MARK A		TERM 2				TERM MARK B		TERM 3			TERM MARK C		TERM 4			TERM MARK D	
	TEST 1	PRAC 1	PRAC 2			TEST 2	PRAC 3	PRAC 4	EXAM			TEST 3	PRAC 5	PRAC 6			TEST 4	PRAC 7	PRAC 8		
Max	50	20	30	95	%	50	15	25	100	190	%	50	20	20	90	%	50	25	15	90	%
1. Learner 1	34	17	20	66	69	29	7	19	62	117	62	37	16	14	67	74	39	20	8	67	74
2. Learner 2 etcetera.																					

CALCULATING TERM MARKS

Example

In order to calculate the **TERM MARKS** for **TERM 1:**

Learner 1 gets the following marks:

Test 1: $^{34}/_{50}$

Practical 1: $^{17}/_{20}$

Practical 2: $^{15}/_{25}$

Total for term: $^{66}/_{95}$

This is 69% ($^{66}/_{95}$ x $^{100}/_{1}$ = 69%).

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

The learner gets a rating code of 6: meritorious achievement.

In the same way, calculate the term marks for each of **TERM 2 (62%) at B, TERM 3 (74%) at C and TERM 4 (74%) at D.**

END-OF-YEAR EXAMINATION

NAMES	EXAMINATION		CONVERSION E
MAX	80	%	60
1. Learner 1	63	79	47
2. Learner 2 etcetera.			

CALCULATING THE EXAM MARKS

- The marks for the examination count 60% or 60 marks out of a 100 of the **FINAL MARK**. This is departmental policy.
- The marks for the written, end-of-year exam must therefore be converted to a mark out of 60.

For example

- Learner 1 gets 63 marks out of 80 for the examination.

- $^{63}/_{80}$ is equal to 79% ($^{63}/_{80}$ x $^{100}/_{1}$ = 79%).
    - Conversion of mark

$^{79}/_{100}$ x $^{60}/_{1}$ = 47 marks out of 60 at E **EXAM MARK**

FINAL MARK

- In Grade 8, the term marks for terms 1, 2, 3 and 4 **each** count 25% (¼) of the **YEAR MARK,** that is, they are weighted equally.
- The **YEAR MARK** counts 40% of the FINAL MARK. This is departmental policy.
- The **YEAR MARK** therefore needs to be converted to a mark out of **40.**

For example:

- First convert the total of the four term marks (A, B, C, D) to a mark out of 40:
  T 1 (A) + T 2 (B) + T 3 (C) + T 4 (D)

  69% + 62% + 74% + 74% = $^{279}/_{400}$ x $^{40}/_{1}$ = **28 marks out of the 40 (F) (YEAR MARK)**

- Lastly, add the **YEAR MARK (F)** out of 40 to the **EXAM MARK (E)** out of 60.
  28 (F) + 47 (E) = 75 out of 100. **FINAL MARK (75%)**.

NAMES	**YEAR MARK F**	**EXAM MARK E**	**FINAL MARK**
MAX	40	60	100
1. Learner 1	28	47	75
2. Learner 2 etc.			

Learner 1 therefore gets 75%, which is 6 on the rating scale: meritorious achievement.

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.

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.

Reporting

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

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

Codes and percentages for reporting in Grades R to 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.

NATURAL SCIENCES: GRADE 8

TERM 1	
TIME	**INTRODUCTION TO NATURAL SCIENCES: ORIENTATION TO HIGH SCHOOL**
½ Week **(1½ hours)**	• Establish links between Natural Sciences and Life Sciences, Physical Sciences and Geography in the FET phase. • Nature of Science: contested knowledge, non-dogmatic, inferences based on evidence, peer review. • **How science works:** All of the following should be explained in simple terms: – Fundamental knowledge built on scientific evidence and verifying findings. – Observing. – Investigating. – Collecting and presenting data/information. – Identifying patterns and relationships in data. – Communicating findings. – Limitations of scientific evidence. – Beginning to understand variables. • **Scientific skills:** – Biological drawings and science diagrams. – Interpreting two-dimensional drawings as three-dimensional objects: transverse and longitudinal sections. – Understanding symmetries. – Introduction to graphs, interpreting graphs. – Overview of the skills listed in the Specific Aims. • **Class organisation and rules** – Using equipment and other resources. – Safety procedures. – Working in groups. – Assessment requirements. **Note**: This introduction must not be assessed. The topics covered in the introduction will be assessed in the context of the specific content in which they apply.

NATURAL SCIENCES: GRADE 8

TERM 1				
AREA 1: EARTH AND BEYOND				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
8 weeks (24 hours)	**Earth in space**	• Earth in space: objects in space, solar system, orbits: predictable motions due to the force of gravity *(links to Grade 7).* • Moon: phases of the moon, eclipses. • Exploring the solar system. • Space, investigating space with telescopes, observing the night sky, star maps. • South Africa's importance for exploring space with telescopes, the southern sky. • Different cultural explanations for various astronomical phenomena. • Sun as a source of energy: seasons, climate, weather systems. • Careers in geography, astronomy	• Construct a model of the earth. Use play dough (a mixture of flour, water, salt and food colouring) **or** use papier-mâché, (newspaper, water, wallpaper glue and poster paint) **or** use natural river clay or mud (sundried), poster paint. or	Textbook. Play dough or papier-mâché or river clay or mud. Torch or lamp. Charts. Posters, star maps.
	Planet earth	• Structure of the earth: crust in relation to biosphere *(links to Grade 8).* • The atmosphere: a mixture of gases, importance of gases, protection of living things. • Green-house effect *(links to Grade 11).* • Human impact on the composition of the atmosphere: Enhanced green-house effect, global warming, climate change. • Careers in astronomy, cosmology, environment, conservation, etcetera.	• Construct a diagram of the earth to show the "layers". • Use a torch or lamp and the model to show the earth-sun-system. • Model the moon orbiting the earth. Use a torch to represent the sun and to show eclipses.	

ASSESSMENTS		One formal class test, worksheets, homework. Refer to the range of skills specified under Specific Aims 1 and 3, and the weighting prescribed on page 10.	Two practical tasks. Refer to the range of skills specified under Specific Aim 2.	
TERM 2				
AREA 2: LIFE AND LIVING				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
8 weeks (28 hours)	**Interactions within environment**	• Ecosystems: terrestrial, aquatic, marine, the diversity of life in these ecosystems. • Energy flow through or in an ecosystem *(links to Grades 7 and 10).* – Photosynthesis: producers. – Consumers: herbivores, carnivores, omnivores. – Decomposers, microorganisms. – Food chains. – Food webs. – Interdependence of organisms. – Plants used by humans as food. • Value of balanced ecosystems: survival of plants and animals. • Disruption of the ecosystem by, for instance, alien plants. • Current environmental issue in the community, for instance, use of pesticides, herbicides, detergents, disposal of wastes, availability of clean water. • Sustainable use of resources, for instance plants or animals used in alternative medicine and as food sources.	• Investigate a local ecosystem: Identify producers, consumers, decomposers. Identify food chains and food webs. Record observations as flow diagrams. (Learners will need assistance.) • Identify and report on plants in the ecosystem that people use as food. or • Research plants in the local area (outside of a specific ecosystem) that people use as food. Access information by interviewing people and consulting reference books. Produce written report. • Identify the alien plants in the	Textbook. Access to local ecosystem. Field guides. Keys.

	Variation and survival	• Adaptations of organisms (plants and animals) in order to survive in the ecosystem, for instance aloes, acacia trees, lithops, springbok, elephants, vultures. – Inherited characteristics: genetic information passed from generation to generation, similarities and differences between parents and offspring (for instance wing colouring in moths, stripes in zebras). – Importance of variation in a population; adaptation. – Survival, natural selection, extinctions. • Selective breeding of plants (for instance maize, sorghum) and domestic animals (for instance cattle, sheep, horses, dogs or cats) in South Africa. • Implications of deliberate genetic changes to organisms, for instance selective breeding. • Careers in animal and plant husbandry, game guarding, farming.	ecosystem. In a sample area, count the number of indigenous and alien plants: Draw conclusions about the effect of alien plants. • Investigate one environmental issue in the local area that impacts on the community. – Identify the causes of the problem. – Collect information about the problem. – Present information as a table or graph. – Interpret information. – Suggest possible solutions.	Textbook. Reference books. Magazines. Newspapers. DVDs.

				Internet.
ASSESSMENT:		One formal class test, worksheets, homework, one mid-year examination. Refer to the range of skills specified in Specific Aims 1 and 3 and the weighting on page 10.	Two practical tasks. Refer to the range of skills specified in Specific Aim 2.	

TERM 3				
AREA 3: MATTER AND MATERIALS				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
8 weeks **(24 hours)**	**Particles, elements and compounds**	• Models in science: atoms and molecules. • Movement of particles, effect of increased energy: physical changes, three phases of matter. • Elements and compounds: difference, types of elements, for instance metals, non-metals, gases, compounds. – Common household compounds: acids and bases, for instance lemon juice vinegar, bleach. – Chemical reactions between elements (word equations). – Indigenous knowledge: use of interactions between materials, for instance for making beer. • Solubility: factors that influence solubility of common compounds, for instance concentration, temperature. • Separation of mixtures: evaporation, distillation. .	•Observe potassium permanganate dissolving in water, or food colouring in water. •Observe the three phases of matter, for instance water, by heating ice. •Observe or demonstrate a variety of chemical reactions, for instance, heating of sodium hydrogen carbonate, decomposing a copper sulphate solution, or electroplating a metal object. •Investigate the factors that affect solubility. Identify variables. •Crystallisation of table salt from a saturated salt solution. Explain this phenomenon. Examine shape of salt crystals by means of a hand lens.	Textbook. Selection of appropriate elements and compounds. Heating device. Hand lens.
ASSESSMENT		One formal class test, worksheets, homework. Refer to the range of skills specified under Specific Aim 2 and the weighting on page 10.	Two practical tasks. Refer to the range of skills specified under Specific Aim 2.	

TERM 4				
AREA 4: ENERGY AND CHANGE				
TIME	**TOPIC**	**CONTENT**	**PRACTICALWORK**	**RESOURCES**
7 Weeks **(21 hours)**	**Energy transfers**	• Transfer of energy in systems: forces that work on objects. • Non-contact forces: magnetism, electrical. – Forces act in pairs. • **Electrical energy:** Cells are a source of energy. – Complete circuits. – Voltage (potential difference) causes current. – Resistances, resistors. – Current: output devices; series and parallel circuits. • **Light energy:** White light as a combination of colours. – travels through space. – transferred by radiation. – transparent and opaque materials. – absorption and reflection. • Seeing: vision (eye), seeing colour, reflected light. • Dispersion: colours of the visible spectrum. • Infrared waves. • Transfer of energy, heating by conduction; convection and radiation.	• Investigate electrical currents using loose wires, cells, light-emitting diodes (LEDs). • Connect bulbs in series and parallel. Observe differences. Make inferences about the effect on current. • Construct a pinhole camera. Record observation and explain how the image is formed. • Investigate absorption and reflection off various surfaces. Relate this to how humans see colours.	Textbook. Cells. Circuit board. Torch bulb. Resistors.
ASSESSMENT		One formal class test, homework, worksheets. End-of-year examinations (1hour). Refer to the range of skills specified under Specific Aims 1 and 3 and the weighting on page 10.	Two selected practical tasks. Refer to the range of skills specified under specific Aim 2.	

CURRICULUM AND ASSESSMENT POLICY STATEMENT: NATURAL SCIENCES

GRADE 9

INTRODUCTION

Natural Sciences in the Senior Phase is compulsory for all learners. It is therefore critical in promoting and developing scientific literacy, as learners may elect not to continue with one of the science subjects beyond Grade 9. Natural Sciences therefore serves a dual purpose: it must enable learners to make sense of the world in scientific terms and prepare learners for continuing with a science(s) into the Further Education and Training (FET) phase … and beyond.

In the Natural Sciences Curriculum, four "Knowledge Areas" are used as organisers for the Physical Sciences, Life Sciences and Earth Sciences elements of the subject. They are intended to serve as a broad introduction to the specialisations (and the Knowledge Strands) of sciences in the FET phase.

Each Knowledge Area is developed progressively across the three years of the Senior Phase. The Knowledge Strands are:

- Life and Living (which leads on to the Knowledge Strands for Life Sciences in FET).
- Matter and Materials (which leads up to the Knowledge Strands for Physical Sciences in FET).
- Energy and Change (which leads up to Knowledge Strands in both Life Sciences and Physical Sciences).
- Earth and Beyond (which leads up to Knowledge Strands in both Life Sciences and Geography).

Neither the Knowledge Areas nor the topics within each Knowledge Area should be treated separately or independently. They are simply a tool for organising the subject content. When teaching Natural Sciences, it is important to emphasise the links that learners need to make with related topics to help them achieve a thorough understanding of the nature of and connectedness between the sciences. These links must also be made progressively across grades.

The Knowledge Areas focus on the ideas, skills, concepts and connections between them, rather than a listing of the facts and procedures that need to be learned. They do not prescribe particular instructional strategies or methodologies. Teachers have the freedom to expand concepts and to design and organise learning experiences according to their local circumstances.

The cognitive and practical skills that have been identified must be taught, and assessed, in an integrated way (and **at the appropriate grade level**) in the context provided by the four Knowledge Areas.

The recommended sequence for the teaching of the four Knowledge Areas in this document for Grade 9 is:

9. Matter and Materials (Area 1)
10. Energy and Change (Area 2)
11. Earth and Beyond (Area 3)
12. Life and Living (Area 4)

However, teachers should decide the sequence in a particular term. In Grade 9, learners are expected to carry out their own investigations to expand on the concepts or knowledge that they have been introduced to and to deepen their understanding of these.

AIMS

There are **three** broad subject specific aims in Natural Sciences. These are

7. Specific Aim 1, which relates to the knowledge or content (theory).
8. Specific Aim 2, which relates to doing science or practical work.
9. Specific Aim 3, which relates to understanding the applications of Natural Science 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 competences have been identified. It is not advisable to try to assess each of the skills separately, nor is it possible to report on individual skills separately. However, **well designed assessments** must show **evidence** that, by the end of the year, all of the skills have been assessed **at a grade-appropriate level**. There must be a clear link between the aims and the outcomes of learning. The assessments are the link.

Whilst learner performance can be reported on separately for Specific Aims 1 (knowing) and 2 (doing) in respect of 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 NATURAL SCIENCES (of Natural Sciences concepts, processes, phenomena, mechanisms, principles, theories, laws, models, etcetera)

The following cognitive (thinking) skills comprise the **range** of skills that all learners should develop in the context of working through the curriculum in a school year. These skills also indicate what should be assessed, **at the**

appropriate grade level, in a variety of assessments during the year. Note that not every skill will be assessed in every assessment, but teachers must ensure that, by the end of the year, learners have been assessed on all of these.

1.7 ACQUIRE KNOWLEDGE

Skills

Learners must…

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

Assessments

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

assessed.

1.8 UNDERSTAND AND MAKE MEANING OF NATURAL SCIENCES

Skills

Learners must…

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

Assessments

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

1.9 APPLY KNOWLEDGE OF NATURAL SCIENCES IN NEW AND UNFAMILIAR CONTEXTS
Skills

Learners must…

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

Assessment

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

6. SPECIFIC AIM 2: INVESTIGATING PHENOMENA IN NATURAL SCIENCES

The following range of skills relate to doing practical work in Natural 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 those that apply to, and which can be assessed in, the context of specific activities. By the end of the Grade 9 year, at least the first six skills must have been assessed at a **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 OR APPARATUS

This should include knowledge of the apparatus, that is, naming it and knowing what it is used for. It includes a variety of different kinds of equipment. "Handling equipment" is a generic skill and would apply to any equipment used for many different kinds of investigation. Handling improvised equipment requires the same skills as would be required for handling standard laboratory equipment.

2.3. MAKE OBSERVATIONS

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

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

2.4. RECORD INFORMATION OR DATA

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

2.5. MEASURE

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

2.6. INTERPRET

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

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

2.7. DESIGN OR PLAN INVESTIGATIONS OR EXPERIMENTS

Not all investigations are based on the "classic" dependent-independent variables and controls. For example, an investigation could

look at observing soil profiles or counting populations.

Also, designing an investigation is a different process from planning an investigation.

Skills include:

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

In Grade 9, learners may need to be assisted to plan and/or design a simple investigation or 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 one form or another, in order to carry out an experiment or investigation. By separating seven different kinds of skill (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 Natural Sciences, including simple investigations or experiments. This approach makes it easier to assess learners in a range of different circumstances and it enables a teacher to judge a learner's ability to **do** science. The skills are based on what learners would do in the normal course of doing practical work. However, in some circumstances only some of these skills would apply and not every skill can be assessed in every practical task.

7. SPECIFIC AIM 3: APPRECIATING AND UNDERSTANDING THE IMPORTANCE AND APPLICATIONS OF NATURAL 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 that is relevant to a discovery or a scientist.

3.2 RELATIONSHIP OF INDIGENOUS KNOWLEDGE TO NATURAL SCIENCES

Note: Examples that are selected (and that should, as far as possible, reflect different South African cultural groupings) **will** also link directly to specific strands in the Natural Sciences subject content.

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

This is about the applications, and relevance, that knowledge of Natural 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, career opportunities exist in respect of socio-biology and animal behaviour, plant pathology, game management, environmental impact studies, preservation of biodiversity, palaeontology, paleoanthropology, agriculture, horticulture, environmental law, science journalism, biotechnology and genetic engineering, and many others. Examples of some of the possibilities are included in the appropriate topics. Learners should be made aware of careers, but these should not be discussed or taught in great detail.

Skills

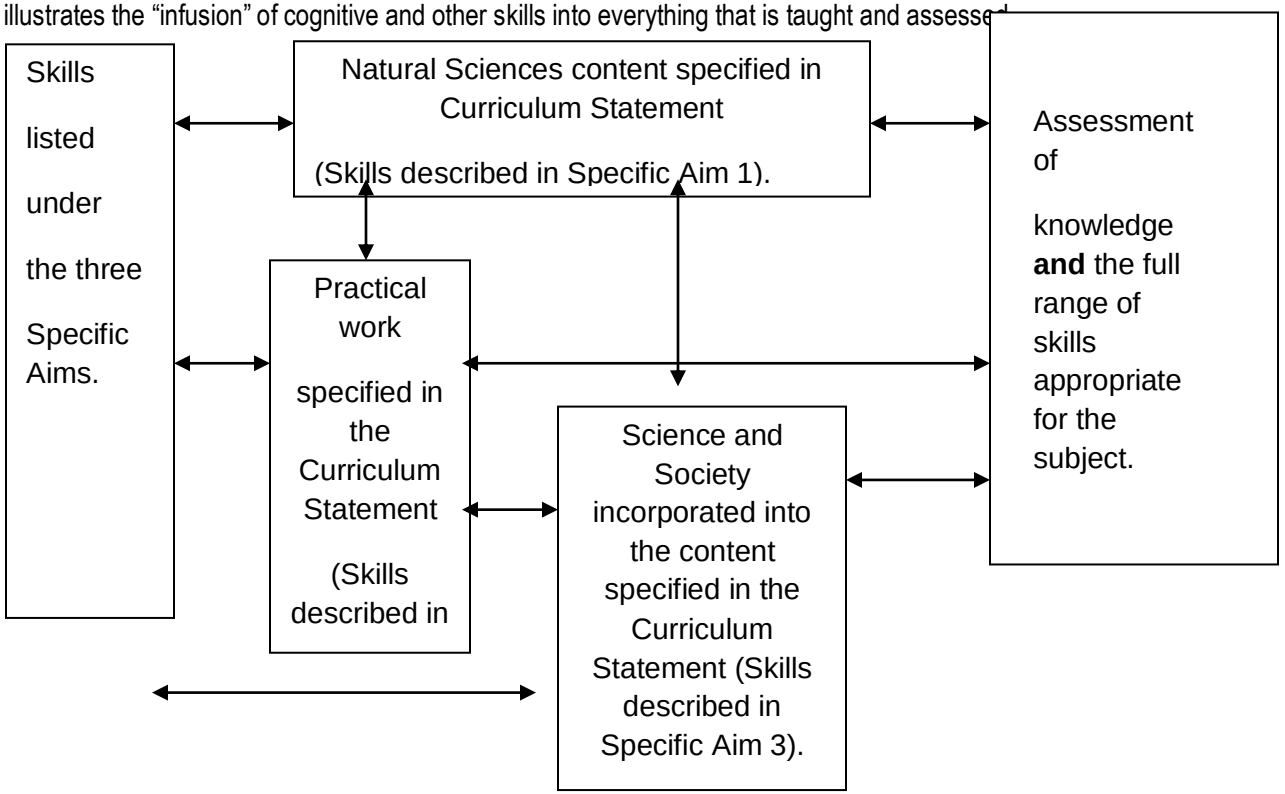
Learners must…

- **analyse** and **evaluate** the application of Natural Sciences in everyday life (both positive and negative consequences).
- **analyse**, **discuss** and **debate** the ethical and legal issues.
- **become** aware of some career opportunities in Natural 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, practical work, Science and Society, as well as 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 9 has been designed to be completed within 31 weeks out of 40 weeks in the school year. This leaves nine 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. In Grade 9, a significant amount of time should be spent on practical tasks and investigations.

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 learners.

Assessment should be mapped against the content and intended aims specified for Natural 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 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 by asking questions and providing answers, class work, such as short pieces of written work completed during the lesson, open-book tests, worksheets or homework exercises, etcetera. 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 involve learners in assessment and allow learners to learn from and reflect on their own performance. In the Senior Phase, learners should be guided and assisted with self- and/or peer assessment.

Informal, ongoing assessments should be used to scaffold the acquisition of knowledge and skills and should be the stepping stones leading up to the formal tasks in the Programmes 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 that are used for formal assessment are recorded and used to determine whether a learner should progress or 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 for 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, etcetera. For Natural Sciences, teachers should identify possible projects suggested in 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%	75%
12	25% including school-based mid-year examinations and "trial" examinations	External examination: 75%

The cognitive demands of assessment used 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 that have been specified under the Specific Aims. The design of these tasks should therefore ensure that a variety of content and skills is assessed. Aims, topics and content in the subject should be used to inform the planning and development of assessment tasks.

Formal assessments in Natural 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 must ensure that this weighting is reflected in the design of individual assessments, for instance class tests, worksheets, projects, etcetera. If this is done for every assessment, and there is evidence that the range is covered, it will not be necessary to report against each of these separately.

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

ASSESSMENT REQUIREMENTS FOR NATURAL SCIENCES: GRADE: 9

<table>
<tr><td colspan="5">PROGRAMME OF FORMAL ASSESSMENT</td></tr>
<tr><td colspan="4">FORMAL, RECORDED SCHOOL-BASED ASSESSMENTS

40%</td><td>END-OF-YEAR INTERNAL EXAMINATION 60%</td></tr>
<tr><td colspan="2">CONTENT</td><td>PRACTICAL</td><td></td><td>WRITTEN EXAMINATION (1½hour)</td></tr>
<tr><td colspan="2">• Four formal class tests.
• One mid-year examination.
• One project (can be done in any term).</td><td>A selection of eight representative practical tasks, which cover the range of skills, must be marked and recorded. The marks allocated to practical tasks should range between 10 and 30.</td><td></td><td>Content, concepts, skills across all topics, including knowledge of practical work. Some of the skills associated with practical work must be assessed in the written exam.</td></tr>
<tr><td colspan="4">SCHOOL-BASED ASSESSMENT (During the year)</td><td>60</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>• One formal class test.
• Two selected practical tasks.</td><td>• One formal class test.
• Two selected practical tasks
• One mid-year examination (1½hour).</td><td>• One formal class test.
• Two selected practical tasks.</td><td>• One formal class test.
• Two selected practical tasks.</td></tr>
<tr><td>25%</td><td>25%</td><td>25%</td><td>25%</td></tr>
<tr><td colspan="4">Convert to 40% (YEAR MARK)</td><td>60% (EXAM MARK)</td></tr>
</table>

RECORDING

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 a different template). All conversions must be reflected.

Note: The marks for the project must be added in to any of the four terms, that is, in the term in which the project was completed.

Names	TERM 1			TERM MARK A		TERM 2				TERM MARK B		TERM 3			TERM MARK C		TERM 4			TERM MARK D	
	TEST 1	PRAC 1	PRAC 2			TEST 2	PRAC 3	PRAC 4	EXAM			TEST 3	PRAC 5	PRAC 6			TEST 4	PRAC 7	PRAC 8		
Maximum	50	20	30	95	%	50	15	25	100	190	%	50	20	20	90	%	50	25	15	90	%
1. Learner 1	34	17	20	66	69	29	7	19	62	117	62	37	16	14	67	74	39	20	8	67	74
2. Learner 2 etcetera																					

CALCULATING TERM MARKS

Example:

In order to calculate the **TERM MARKS** for **TERM 1:**

Learner 1 gets the following marks:

Test 1: $^{34}/_{50}$

Practical 1: $^{17}/_{20}$

Practical 2: $^{15}/_{25}$

Total for term: $^{66}/_{95}$

This is 69% ($^{66}/_{95}$ x $^{100}/_{1}$ = 69%).

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

The learner gets a rating code of 6: meritorious achievement.

In the same way, calculate the term marks for each of **TERM 2 (62%) at B, TERM 3 (74%) at C and TERM 4 (74%) at D.**

END-OF-YEAR EXAMINATION

NAMES		EXAMINATION		CONVERSION E
	MAXIMUM	80	%	60
1. Learner 1		63	79	47
2. Learner 2 etcetera.				

CALCULATING THE EXAM MARKS

- The marks for the examination count 60%, or 60 marks out of a 100, of the **FINAL MARK**. This is departmental policy.
- The marks for the written, end-of-year exam must therefore be converted to a mark out of 60.

For example

- Learner 1 gets 63 marks out of 80 for the examination.
  - $^{63}/_{80}$ is equal to 79% ($^{63}/_{80}$ x $^{100}/_{1}$ = 79%).
  - Conversion of mark

    $^{79}/_{100}$ x $^{60}/_{1}$ = 47 marks out of 60 at E **EXAM MARK**

FINAL MARK

- In Grade 9, the term marks for terms 1, 2, 3 and 4 **each** count 25% (¼) of the **YEAR MARK,** in other words, they are weighted equally.
- The **YEAR MARK** counts 40% of the FINAL MARK. This is departmental policy.
- The **YEAR MARK** therefore needs to be converted to a mark out of **40.**

For example:

- First convert the total of the four term marks (A, B, C, D) to a mark out of 40:
  T 1 (A) + T 2 (B) + T 3 (C) + T 4 (D)

  69% + 62% + 74% + 74% = $^{279}/_{400}$ x $^{40}/_{1}$ = **28 marks out of the 40 (F) (YEAR MARK)**

- Lastly, add the **YEAR MARK (F)** out of 40 to the **EXAM MARK (E)** out of 60.
  28 (F) + 47 (E) = 75 out of 100 **FINAL MARK (75%)**.

NAMES		**YEAR MARK F**	**EXAM MARK E**	**FINAL MARK**
	MAXIMUM	40	60	100
1. Learner 1		28	47	75
2. Learner 2 etcetera				

Learner 1 therefore gets 75%, which is 6 on the rating scale: meritorious achievement.

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.

Reporting

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

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

Codes and percentages for reporting in Grades R to 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.

NATURAL SCIENCES: GRADE 9				
TERM 1				
AREA 1: MATTER AND MATERIALS				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
8 weeks (24hours)	**Chemical reactions**	• Pure substances, elements and compounds. Classify substances. • Names of elements, symbols. • Names of compounds, using names of elements from which they derive; common names of compounds, for instance water, salt. • Properties of metals. • Properties of non-metals. • Introduction to the periodic table: Mendeleev, patterns in the periodic table. • Chemical reactions (word equations): – useful reactions, for instance metal from metal oxides, silver nitrate in photography. – harmful reactions, for instance rusting. – acids and bases (pH measurement), for instance swimming pool chemistry: – anions and cations. • Balanced chemical equations (symbols). • Careers in chemistry (inorganic or organic), chemical engineering, manufacturing, etcetera.	• Investigate the properties of metals: ▪ hot water and Vaseline or wax to test for conductivity. ▪ 9-volt battery and wires to test for electrical conductivity. ▪ hammer and pliers to test for malleability and ductility. Construct a table to show results. Report on conclusions. • Investigate the properties of some nonmetals. Construct a table to show results. • Investigate reactions between weak acids and bases.	Textbook. Periodic table. Assortment of metals: copper, zinc, aluminium, lead, tin etcetera. 9-volt battery. Vaseline or wax. Pliers. Hammer. Heat source. Thermometer. Indicator strips. • Carbon rod, sulphur, graphite,

				iodine. (Do **not** use phosphorus.)
ASSESSMENT		One formal class test, homework, worksheets, summaries, etcetera. Refer to the range of skills specified under Specific Aims 1 and 3 and the weighting on page 10.	Two practical tasks. Refer to range of skills specified under Specific Aim 2.	

TERM 2				
AREA 2: ENERGY AND CHANGE:				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
7 weeks **(21 hours)**	**Energy transfers:**	• Process of energy transfer in the following situations: ▪ changing a resistor in a parallel part of an electrical circuit. ▪ endothermic and exothermic chemical reactions. ▪ work done against friction or gravity (requires energy and produces heat). ▪ energy released from food during respiration. ▪ heating of an insulated body. ▪ heating of a non-insulated body. • Effect of variables, for instance effect of ▪ type of surface (shiny or dull) on heat transfer. ▪ increased surface area on heat transfer. ▪ varying number of resistances in parallel circuit. ▪ friction force between different materials. • Varying one condition.	• Design and carry out investigations to test effect of variables in a system by varying one condition. • Take necessary measurements. Describe relationship between variables (x and y). • Record results and show results as graphs.	Textbook. Selection of different surfaces and materials. Circuit board. Battery. Resistors. Heat source.
ASSESSMENT		One formal class test, homework, worksheets, mid-year examination (1½ hour). Refer to the range of the skills specified in Specific Aims 1 and 3. and the weighting on page 10.	Two practical tasks. Refer to the range of skills specified under Specific Aim 2.	

TERM 3				
AREA 3: EARTH AND BEYOND				
TIME	**TOPIC**	**CONTENT**	**PRACTICAL WORK**	**RESOURCES**
4½ weeks (13½ hours)	**Mining and minerals**	• Mining and mineral extraction in South Africa ▪ origins of coal *(links to Grade 7).* ▪ origins of ore and minerals. • Economic, environmental and social cost attached to the – mining. – production. – use of economically important materials, for instance gold, titanium dioxide, platinum, diamonds, coal, iron. • Raw materials and processed products. • Methods of extracting metals from ores. • Indigenous technology for iron extraction.	• Research the cost to the environment of: mining, production and use of **one** of the following: gold, platinum, diamonds, coal, titanium dioxide, iron. Present data in a written report which includes tables and graphs. Analyse and interpret information.	Textbook. Newspapers. Internet. Television.
AREA 4: LIFE AND LIVING				
3½ weeks (10½ hours)	**Basic units of life**	• Basic structure of generalised plant and animal cells. • Essential processes in plants. – Photosynthesis in plant cells. – Respiration in plant and animal cells. – Protein synthesis in plant and animal cells. Refer to the roles of proteins in cells. Refer to the flow of energy in cells.	• Examine plant and animal cells. Record observations as biological drawings.	Textbook. ○ Microscope slides or prepared slides or micrographs.

Total: 8 weeks (24hours)				
ASSESSMENT		One formal class test, homework, worksheets, summaries, mind maps. Refer to the range of skills specified under Specific Aims 1 and 3 and the weighting on page 10.	Two practical tasks. Refer to the range of skills specified under Specific Aim 2.	

TERM 4				
AREA 4 LIFE AND LIVING				
TIME	**TOPIC**	**ONTENT**	**PRACTICAL WORK**	**RESOURCES**
8 weeks **(24 hrs)**	**Human life processes and healthy living.**	Relationship between human systems and life processes. (This must be presented as an orientation to the systems that will be dealt with in Grades 10 to 12. No detail required.) • Lungs and breathing. • Alimentary canal and nutrition. • Heart, blood vessels and circulation. • Kidneys and excretion. • Skeleton, muscles and movement/locomotion. • Sense organs and sensing environment. • Growth and repair or hearing. • Sex organs and reproduction. Interdependence of systems. • Basic health, balanced diet, exercise. • Effects of alcohol, tobacco, drugs. • Modern medicines from natural products, for instance aspirin, progesterone, oestrogen, chloroquinine: Indigenous knowledge. • Diseases, disorders related to the above systems. (Note: Learners should each elect **one** of the diseases to research.)	• Measure and compare heart rate before and after exercise. • Measure and compare lung capacity. Record measurements in table form. Analyse and interpret results. • Dissection and observation of sheep **or** pig heart. • Dissection and observation of sheep or pig kidneys. and/or • Observation and dissection of sheep or pig lungs. • Research and report on a disease of **ONE** of the	Textbook. Models or charts: – Torso – Heart – Kidney – Eye – Ear From butchery: pig or sheep – Heart – Kidney – Lungs – Eye

	Human reproduction.		following: lungs, heart, alimentary canal, kidneys, skeleton, muscles, joints, external reproductive organs. • Research and evaluate the effectiveness of different contraceptives in respect of disease prevention. Write up information as a report.	• Reference books. • Consult pharmacist, doctor or clinic. • Pamphlets.
ASSESSMENT		One formal class test, worksheets, homework. One examination (1½ hour). Refer to the range of skills specified under Specific Aims 1 and 3 and the weighting on page 10.	Two practical tasks. Refer to range of skills specified under Specific Aim 2.	