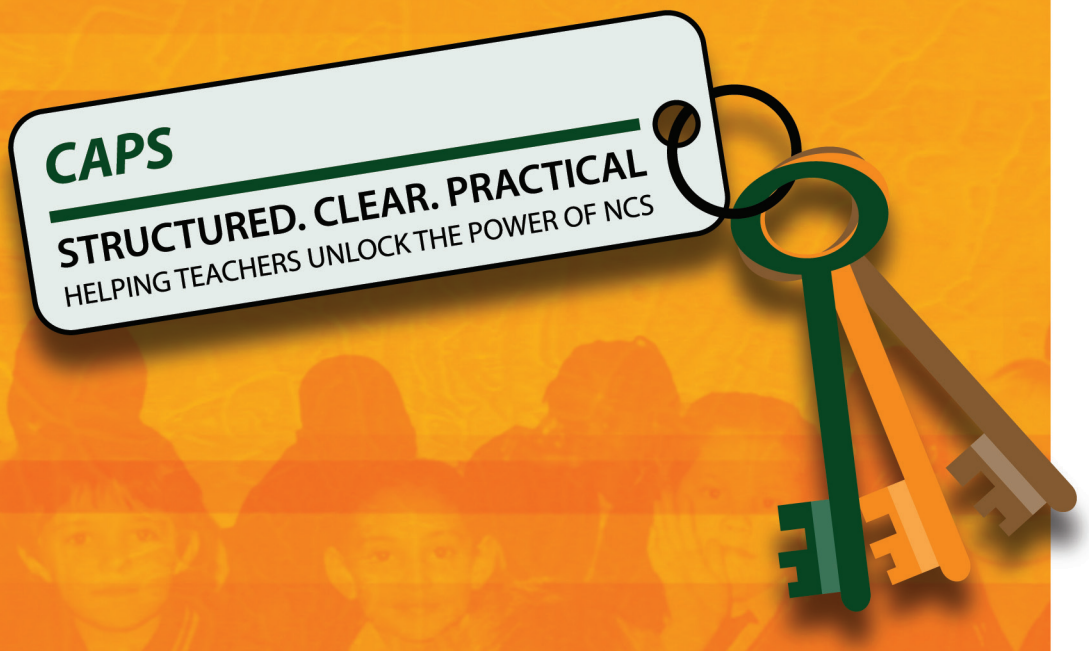
NATURAL SCIENCES

National Curriculum Statement (NCS)

Curriculum and Assessment Policy Statement



Senior Phase
Grades 7-9

basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

CURRICULUM AND ASSESSMENT POLICY STATEMENT
GRADES 7-9

NATURAL SCIENCES

DISCLAIMER

In view of the stringent time requirements encountered by the Department of Basic Education to effect the necessary editorial changes and layout to the Curriculum and Assessment Policy Statements and the supplementary policy documents, possible errors may occur in the said documents placed on the official departmental websites.

There may also be vernacular inconsistencies in the language documents at Home-, First and Second Additional Language levels which have been translated in the various African Languages. Please note that the content of the documents translated and versioned in the African Languages are correct as they are based on the English generic language documents at all three language levels to be implemented in all four school phases.

If any editorial, layout or vernacular inconsistencies are detected, the user is kindly requested to bring this to the attention of the Department of Basic Education.

E-mail: capslangcomments@dbe.gov.za or fax (012) 328 9828

Department of Basic Education
222 Struben Street
Private Bag X895
Pretoria 0001
South Africa
Tel: +27 12 357 3000
Fax: +27 12 323 0601

120 Plein Street Private Bag X9023
Cape Town 8000
South Africa
Tel: +27 21 465 1701
Fax: +27 21 461 8110
Website: http://www.education.gov.za

© 2011 Department of Basic Education

ISBN: 978-1-4315-0528-9

Design and Layout by: Ndabase Printing Solution

Printed by: Government Printing Works

FOREWORD BY THE MINISTER

Our national curriculum is the culmination of our efforts over a period of seventeen years to transform the curriculum bequeathed to us by apartheid. From the start of democracy we have built our curriculum on the values that inspired our Constitution (Act 108 of 1996). The Preamble to the Constitution states that the aims of the Constitution are to:

- heal the divisions of the past and establish a society based on democratic values, social justice and fundamental human rights;
- improve the quality of life of all citizens and free the potential of each person;
- lay the foundations for a democratic and open society in which government is based on the will of the people and every citizen is equally protected by law; and
- build a united and democratic South Africa able to take its rightful place as a sovereign state in the family of nations.

Education and the curriculum have an important role to play in realising these aims.

In 1997 we introduced outcomes-based education to overcome the curricular divisions of the past, but the experience of implementation prompted a review in 2000. This led to the first curriculum revision: the *Revised National Curriculum Statement Grades R-9* and the *National Curriculum Statement Grades 10-12* (2002).

Ongoing implementation challenges resulted in another review in 2009 and we revised the *Revised National Curriculum Statement* (2002) and the *National Curriculum Statement Grades 10-12* to produce this document.

From 2012 the two National Curriculum Statements, for *Grades R-9* and *Grades 10-12* respectively, are combined in a single document and will simply be known as the *National Curriculum Statement Grades R-12.* The *National Curriculum Statement for Grades R-12* builds on the previous curriculum but also updates it and aims to provide clearer specification of what is to be taught and learnt on a term-by-term basis.

The *National Curriculum Statement Grades R-12* represents a policy statement for learning and teaching in South African schools and comprises of the following:

(a) Curriculum and Assessment Policy Statements (CAPS) for all approved subjects listed in this document;

(b) *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12*; and

(c) *National Protocol for Assessment Grades R-12.*

MRS ANGIE MOTSHEKGA, MP
MINISTER OF BASIC EDUCATION

CONTENTS

SECTION 1: INTRODUCTION TO THE CURRICULUM AND ASSESSMENT POLICY STATEMENT 3

1.1 Background 3

1.2 Overview 3

1.3 General aims of the South African Curriculum 4

1.4 Time Allocation 6

1.4.1 Foundation Phase 6

1.4.2 Intermediate Phase 6

1.4.3 Senior Phase 7

1.4.4 Grades 10-12 7

SECTION 2: INTRODUCTION TO NATURAL SCIENCES 8

2.1 Introduction 8

2.2 Indigenous knowledge systems and Natural Sciences 8

2.3 Teaching Natural Sciences 8

2.4 Organisation of the Natural Sciences Curriculum 9

2.5 Allocation of teaching time 9

2.6 Specific aims 10

2.7 Process Skills 10

2.8 Resources 12

2.9 Detailed summary of Natural Sciences concepts and content, and time allocations 13

SECTION 3: SENIOR PHASE NATURAL SCIENCES CONTENT AND CONCEPTS 17

SECTION 4: ASSESSMENT 85

4.1 INTRODUCTION 85

4.2 INFORMAL ASSESSMENT OR DAILY ASSESSMENT 85

4.3 FORMAL ASSESSMENT 86

4.4 FORMAL ASSESSMENT REQUIREMENTS FOR NATURAL SCIENCES 87

4.5 RECORDING AND REPORTING 89

4.6 MODERATION OF ASSESSMENT 93

4.7 GENERAL 93

SECTION 1: INTRODUCTION TO THE CURRICULUM AND ASSESSMENT POLICY STATEMENT

1.1 BACKGROUND

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

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

1.2 OVERVIEW

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1.3 GENERAL AIMS OF THE SOUTH AFRICAN CURRICULUM

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

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

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

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

- Social transformation: ensuring that the educational imbalances of the past are redressed, and that equal educational opportunities are provided for all sections of the population;
- Active and critical learning: encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths;
- High knowledge and high skills: the minimum standards of knowledge and skills to be achieved at each grade are specified and set high, achievable standards in all subjects;

- Progression: content and context of each grade shows progression from simple to complex;
- Human rights, inclusivity, environmental and social justice: infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. The National Curriculum Statement Grades R-12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors;
- Valuing indigenous knowledge systems: acknowledging the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution; and
- Credibility, quality and efficiency: providing an education that is comparable in quality, breadth and depth to those of other countries.

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

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

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

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

1.4 TIME ALLOCATION

1.4.1 Foundation Phase

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

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

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

(c) Ten hours are allocated for languages in Grades R-2 and 11 hours in Grade 3. A maximum of 8 hours and a minimum of 7 hours are allocated for Home Language and a minimum of 2 hours and a maximum of 3 hours for Additional Language in Grades 1-2. In Grade 3 a maximum of 8 hours and a minimum of 7 hours are allocated for Home Language and a minimum of 3 hours and a maximum of 4 hours for First Additional Language.

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

1.4.2 Intermediate Phase

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

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

1.4.3 Senior Phase

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

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

1.4.4 Grades 10-12

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

SUBJECT	TIME ALLOCATION PER WEEK (HOURS)
Home Language	**4.5**
First Additional Language	**4.5**
Mathematics	**4.5**
Life Orientation	**2**
A minimum of any three subjects selected from **Group B** Annexure B, Tables B1-B8 of the policy document, *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12,* subject to the provisos stipulated in paragraph 28 of the said policy document.	**12 (3x4h)**
TOTAL	**27, 5**

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: INTRODUCTION TO NATURAL SCIENCES

2.1 INTRODUCTION

Science as we know it today has roots in African, Arabic, Asian, European and American cultures. It has been shaped by the search to understand the natural world through observation, testing and proving of ideas, and has evolved to become part of the cultural heritage of all nations. In all cultures and in all times people have wanted to understand how the physical world works and have needed explanations that satisfy them.

What is Science?

Science is a systematic way of looking for explanations and connecting the ideas we have. In Science certain methods of inquiry and investigation are generally used. These methods lend themselves to replication and a systematic approach to scientific inquiry that attempts at objectivity. The methods include formulating hypotheses, and designing and carrying out experiments to test the hypotheses. Repeated investigations are undertaken, and the methods and results are carefully examined and debated before they are accepted as valid.

The science knowledge we teach at school is not in doubt – most of it has been tested and known since the 1800s – but a good teacher will tell the learners something of the arguments and confusion among the people who were the first to investigate this knowledge.

Science also explores the frontiers of the unknown. There are many unanswered questions such as: Why is climate changing around the world? What is making the universe expand? What causes the earth's magnetic field to change? As with all knowledge, scientific knowledge changes over time as scientists acquire new information and people change their ways of viewing the world.

2.2 INDIGENOUS KNOWLEDGE SYSTEMS AND NATURAL SCIENCES

Our forebears would not have survived if they had not been able to learn about the natural world they depended on. They made careful observations, recognised regular patterns in seasons, the life cycles of plants, and the behaviour of animals.

They had theories about cause and effect too, and understood many of the relationships in the environment where they lived. These sets of knowledge, each woven into the history and place of people, are known as indigenous knowledge systems.

Indigenous knowledge includes knowledge about agriculture and food production, pastoral practices and animal production, forestry, plant classification, medicinal plants, management of biodiversity, food preservation, management of soil and water, iron smelting, brewing, making dwellings and understanding astronomy. As society changes, some of that knowledge is being lost. People such as biologists, pharmacists and archaeologists are seeking it out and writing it down before it is gone.

2.3 TEACHING NATURAL SCIENCES

Careful selection of content, and use of a variety of approaches to teaching and learning Science, should promote understanding of:

- Science as a discipline that sustains enjoyment and curiosity about the world and natural phenomena

- the history of Science and the relationship between Natural Sciences and other subjects
- the different cultural contexts in which indigenous knowledge systems have developed
- the contribution of Science to social justice and societal development
- the need for using scientific knowledge responsibly in the interest of ourselves, of society and the environment
- the practical and ethical consequences of decisions based on Science.

Natural Sciences at the Senior Phase level lays the basis of further studies in more specific Science disciplines, such as Life Sciences, Physical Sciences, Earth Sciences or Agricultural Sciences. It prepares learners for active participation in a democratic society that values human rights and promotes responsibility towards the environment. Natural Sciences can also prepare learners for economic activity and self-expression.

2.4 ORGANISATION OF THE NATURAL SCIENCES CURRICULUM

In this curriculum, the knowledge strands below are used as a tool for organising the content of the subject Natural Sciences.

Natural Sciences Knowledge Strands
Life and Living
Matter and Materials
Energy and Change
Planet Earth and Beyond

Each Knowledge Strand is developed progressively across the three years of the Senior Phase. The Knowledge Strands 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 the connectedness in Natural Sciences. Links must also be made progressively, across grades to all Knowledge Strands.

2.5 ALLOCATION OF TEACHING TIME

Time for Natural Sciences has been allocated in the following way:

- 10 weeks per term, with 3 hours per week
- Grades 7, 8 and 9 have been designed to be completed within 34 weeks
- 6 hours have been included for assessment in terms 1 and 3
- Terms 2 and 4 work will cover 8 weeks each, plus 2 weeks for revision and examinations

The time allocated per topic is a **guideline** and should be applied flexibly according to circumstances in the classroom and to accommodate the interests of the learners.

The time allocations given to the different topics provide an indication of the weighting of each topic.

In all Grades, a significant amount of time should be spent on doing practical tasks and investigations which are an integral part of the teaching and learning process. See detailed time allocation in **Section 2.9**

2.6 SPECIFIC AIMS

This curriculum aims to provide learners with opportunities to make sense of ideas they have about nature. It also encourages learners to ask questions that could lead to further research and investigation.

There are **three** specific aims in Natural Sciences

Specific Aim 1: 'Doing Science'

Learners should be able to complete investigations, analyse problems and use practical processes and skills in evaluating solutions.

Learners plan and do simple investigations and solve problems that need some practical ability. Attitudes and values underpin this ability. Respect for living things is an example – learners should not damage plants; if they examine small animals they should care for them and release them in the place where they found them.

Specific Aim 2: 'Knowing the subject content and making connections'

Learners should have a grasp of scientific, technological and environmental knowledge and be able to apply it in new contexts.

The main task of teaching is to build a framework of knowledge for learners and to help them make connections between the ideas and concepts in their minds – this is different to learners just knowing facts. When learners do an activity, questions and discussion must follow and relate to previously acquired knowledge and experience, and connections must be made.

Specific Aim 3: 'Understanding the uses of Science '

Learners should understand the uses of Natural Sciences and indigenous knowledge in society and the environment.

Science learnt at school should produce learners who understand that school science can be relevant to everyday life. Issues such as improving water quality, growing food without damaging the land and building energy-efficient houses are examples of applications.

An appreciation of the history of scientific discoveries, and their relationship to indigenous knowledge and different world views, enriches our understanding of the connections between Science and Society.

2.7 PROCESS SKILLS

The teaching and learning of Natural Sciences involves the development of a range of process skills that may be used in everyday life, in the community and in the workplace. Learners also develop the ability to think objectively and use a variety of forms of reasoning while they use these skills. Learners can gain these skills in an environment that taps into their curiosity about the world, and that supports creativity, responsibility and growing confidence.

The following are the cognitive and practical process skills that learners will be able to develop in Natural Sciences

1. Accessing and recalling information – being able to use a variety of sources to acquire information, and to remember relevant facts and key ideas, and to build a conceptual framework

2. Observing – noting in detail objects, organisms and events

3. Comparing – noting similarities and differences between things

4. Measuring – using measuring instruments such as rulers, thermometers, clocks and syringes (for volume)

5. Sorting and classifying – applying criteria in order to sort items into a table, mind-map, key, list or other format

6. Identifying problems and issues – being able to articulate the needs and wants of people in society

7. Raising questions – being able to think of, and articulate relevant questions about problems, issues, and natural phenomena

8. Predicting – stating, before an investigation, what you think the results will be for that particular investigation

9. Hypothesizing – putting forward a suggestion or possible explanation to account for certain facts. A hypothesis is used as a basis for further investigation which will prove or disprove the hypothesis

10. Planning investigations – thinking through the method for an activity or investigation in advance. Identifying the need to make an investigation a fair test by keeping some things (variables) the same whilst other things will vary

11. Doing investigations – this involves carrying out methods using appropriate apparatus and equipment, and collecting data by observing and comparing, measuring and estimating, sequencing, or sorting and classifying. Sometimes an investigation has to be repeated to verify the results.

12. Recording information – recording data from an investigation in a systematic way, including drawings, descriptions, tables and graphs

13. Interpreting information – explaining what the results of an activity or investigation mean (this includes reading and understanding maps, tables, graphs). *A Translation Task requires learners to make sense of information and convert the information into a different format e.g. from information captured on a table into a graph format and or written format.*

14. Communicating – using written, oral, visual, graphic and other forms of communication to make information available to other people

15. **The Scientific Process** is a way of investigating things about the world. Scientists use this process to find out about the world and to solve problems. The steps that make up the scientific process are not necessarily in order (sequential), and may include:

    Step 1: Identify a problem and develop a question. What is it you want to find out?

    Step 2: Form a hypothesis. A hypothesis is your idea, answer, or prediction about what will happen and why.

    Step 3: Design an activity or experiment. Do something that will help you test your idea or prediction to see if you were right.

Step 4: Observe/note changes/reactions (e.g. through measuring), and record your observations (e.g. onto a table). What were the results of your activity or experiment? Write about what happened.

Step 5: Make inferences about the observations recorded in the tables, graphs, drawings, photographs. Make some conclusions. What did you find out? Do your results support your hypothesis? What did you learn from this investigation?

Developing Language Skills: Reading and Writing

The ability to read well is central to successful learning across the curriculum. Writing is also a powerful instrument of communication. Writing allows learners to construct and communicate thoughts and ideas coherently. Frequent reading and writing practice across a variety of tasks and subjects enables learners to communicate functionally and creatively.

Learners are required to read and write particular genres of texts (including instructions, reports and explanations) during Natural Sciences lessons. Learners need regular opportunities to read and write a range of genres in order to improve their reading and writing skills. The ability to read and write well is also critical when learners are assessed, both informally and formally.

2.8 RESOURCES

The resources needed for teaching Natural Sciences are listed against each topic in order to assist teachers with planning and preparation. The list is a guide and suitable alternative tools and materials may be used.

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

Every learner should have access to sufficient workspace and equipment to carry out investigations. For safety and educational reasons it is recommended that no more than three learners share space and equipment. Teachers should ensure that learners are familiar with rules regarding the safe use of equipment.

Schools must make every effort to ensure that the essential equipment is provided. Tools, apparatus, materials and consumables must be acquired through a planned budgeting process. Secure storage for equipment must be provided by the school.

While it is acknowledged that it is not ideal to have to improvise equipment, teachers should remember that it is more important for learners to have the experience of carrying out a variety of investigations than to depend on the availability of equipment. In instances where equipment is limited, teachers should be encouraged to improvise. The same knowledge and skills can be developed using improvised equipment.

In instances where there is no alternative, it is more effective for teachers to demonstrate an investigation than not to do investigations due to a lack of equipment.

2.9 DETAILED SUMMARY OF NATURAL SCIENCES CONCEPTS AND CONTENT, AND TIME ALLOCATIONS

Each term focuses on one Natural Sciences knowledge strand

- The strands are organised to show clear progression of concepts across the Grades and in the phase.

GRADE	TERM 1: LIFE & LIVING		TERM 2: MATTER & MATERIALS		TERM 3: ENERGY & CHANGE		TERM 4: PLANET EARTH & BEYOND		TOTAL
	TOPIC	WKS	TOPIC	WKS	TOPIC	WKS	TOPIC	WKS	
7	• **The biosphere** - The concept of the biosphere - Requirements for sustaining life` • **Biodiversity** - Classification of living things - Diversity of animals - Diversity of plants • **Sexual Reproduction** - Sexual Reproduction in Angiosperms - Human Reproduction • **Variation** - Variations exists within a species	1 3 ½ 3 ½ 1 **9 wks**	• **Properties of materials** - Physical properties of materials - Impact on the environment • **Separating mixtures** - Mixtures - Methods of physical separation - Sorting and recycling materials • **Acids, bases and neutrals** - Tastes of substances - Properties of acids, bases and neutrals - Acid-base indicators • **Introduction to the Periodic Table of Elements** - Arrangement of elements on the Periodic Table - Some properties of metals, semi-metals and non-metals	2 2 2 2 **8 wks**	• **Sources of energy** - Renewable and non-renewable sources of energy • **Potential and Kinetic Energy** - Potential energy - Kinetic energy - Potential and kinetic energy in systems - Law of conservation of energy • **Heat transfer** - Heating as a transfer of energy - Conduction - Convection - Radiation • **Insulation and energy saving** - Using insulating materials • **Energy transfer to surroundings** - Useful and 'wasted' energy • **The national electricity supply system** - Energy transfers in the national grid - Conserving electricity in the home	1 2 2 2 1 1 **9 wks**	• **Relationship of the Sun to the Earth** - Solar energy and the Earth's seasons - Solar energy and life on Earth - Stored solar energy • **Relationship of the Moon to the Earth** - Relative positions - Gravity - Tides • Historical development of astronomy - Early indigenous knowledge - Modern developments	4 2 2 **8 wks**	**34 weeks**

GRADE	TERM 1: LIFE & LIVING		TERM 2: MATTER & MATERIALS		TERM 3: ENERGY & CHANGE		TERM 4: PLANET EARTH & BEYOND		TOTAL
	TOPIC	**WKS**	**TOPIC**	**WKS**	**TOPIC**	**WKS**	**TOPIC**	**WKS**	
8	• **Photosynthesis and respiration** - Photosynthesis - Respiration • **Interactions and interdependence within the environment** - Introduction to ecology - Ecosystems - Feeding relationships - Energy flow: Food chains and food webs - Balance in an ecosystem - Adaptations - Conservation of the ecosystem • **Micro-organisms** - Types of micro-organisms - Harmful micro-organisms - Useful micro-organisms	2 5 2 **9 wks**	• **Atoms** - Atoms – building blocks of matter - Sub atomic particles - Pure substances - Elements - Compounds - Mixtures of elements and compounds • **Particle model of matter** - The concept of the particle model of matter - Change of state - Density, mass and volume - Density and states of matter - Density of different materials - Expansion and contraction of materials - Pressure • **Chemical reactions** - Reactants and products	2 5 1 **8 wks**	• **Static electricity** - Friction and static electricity • **Energy transfer in electrical systems** - Circuits and current electricity - Components of a circuit - Effects of an electric current • **Series and parallel circuits** - Series circuits - Parallel circuits - Other output devices • **Visible light** - Radiation of light - Spectrum of visible light - Opaque and transparent substances - Absorption of light - Reflection of light - Seeing light - Refraction of light	1 3 2 3 **9 wks**	• **The Solar System** - The Sun - Objects around the Sun - Earth's position in the Solar System • **Beyond the Solar System** - The Milky Way Galaxy - Our nearest star - Light years, light hours and light minutes - Beyond the Milky Way Galaxy • **Looking into space** - Early viewing of space - Telescopes	3 3 2 **8 wks**	**34 weeks**

GRADE	TERM 1: LIFE & LIVING		TERM 2: MATTER & MATERIALS		TERM 3: ENERGY & CHANGE		TERM 4: PLANET EARTH & BEYOND		TOTAL
	TOPIC	**WKS**	**TOPIC**	**WKS**	**TOPIC**	**WKS**	**TOPIC**	**WKS**	
9	• **Cells as the basic units of life** - Cell structure - Differences between plant and animal cells - Cells in tissues, organs and systems • Systems in the human body - Body systems • **Human reproduction** - Purpose and puberty - Reproductive organs - Stages of reproduction • **Circulatory and respiratory systems** - Breathing, gaseous exchange, circulation and respiration • **Digestive system** - Healthy diet - The alimentary canal and digestion	2 2 2 1 ½	• **Compounds** - The Periodic Table - Names of compounds • **Chemical reactions** - Chemical equations to represent reactions - Balanced equations • **Reactions of metals with oxygen** - The general reaction of metals with oxygen - Reaction of iron with oxygen - Reaction of magnesium with oxygen - Formation of rust - Ways to prevent rusting • **Reactions of non-metals with oxygen** - The general reaction of non-metals with oxygen - Reaction of carbon with oxygen - Reaction of sulfur with oxygen • **Acids & bases, and pH value** - The concept of pH value	1 1 1 ½ 1	• **Forces** - Types of forces - Contact forces - Field forces (non-contact forces) • **Electric cells as energy systems** - Electric cells • **Resistance** - Uses of resistors - Factors that affect resistance in a circuit • **Series and parallel circuits** - Series circuits - Parallel circuits • **Safety with electricity** - Safety practices • **Energy and the national electricity grid** - Electricity generation - Nuclear power in South Africa - National electricity grid • **Cost of electrical power** - The cost of power consumption	2 ½ 1 2 ½ 1	• **The Earth as a system** - Spheres of the Earth • **Lithosphere** - Lithosphere - The rock cycle • **Mining of mineral resources** - Extracting ores - Refining minerals - Mining in South Africa • **Atmosphere** - Atmosphere - Troposphere - Stratosphere - Mesosphere - Thermosphere - The greenhouse effect • **Birth, life and death of stars** - The birth of a star - Life of a star - Death of a star	1 2 2 2	**34 weeks**

GRADE	TERM 1: LIFE & LIVING		TERM 2: MATTER & MATERIALS		TERM 3: ENERGY & CHANGE		TERM 4: PLANET EARTH & BEYOND		TOTAL
	TOPIC	**WKS**	**TOPIC**	**WKS**	**TOPIC**	**WKS**	**TOPIC**	**WKS**	
		1 ½	• **Reactions of acids with bases: Part I** - Neutralisation and pH • **Reactions of acids with bases: Part II** - The general reaction of an acid with a metal oxide (base) - Applications - The general reaction of an acid with a metal hydroxide *(base)* • **Reactions of acids with bases: Part III** - *The general reaction of an acid with a metal carbonate (base)*	1 ½ 1 ½ ½		2		1	**34 weeks**
		9 wks	**Reactions of acids with metals**	**8 wks**		**9 wks**		**8 wks**	

Teachers have the freedom to expand concepts and to design and organise learning experiences according to their own local circumstances.

Examples of indigenous knowledge that teachers select for study should, as far as possible, reflect different South African cultural groupings. They should also link directly to specific content in the Natural Sciences curriculum.

Notes: * These totals include the **6 hours** per term for school-based assessment but exclude the **2 weeks** set aside for the mid-year and the end of year examinations

General: Time spent on each topic should serve as a guideline for weighting of marks in Tests and Exams. The purpose of using times as guidelines is to ensure that all topics are assessed.

SECTION 3: SENIOR PHASE NATURAL SCIENCES CONTENT AND CONCEPTS

GRADE 7 TERM 1				
STRAND: LIFE AND LIVING				
TIME	**TOPIC**	**CONTENT & CONCEPTS**	**SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS**	**EQUIPMENT AND RESOURCES**
1 week	**The biosphere**	**The concept of the biosphere** • the biosphere is where life exists and includes the lithosphere (soil and rocks), hydrosphere (water), and atmosphere (gases) • it also includes all living organisms, and dead organic matter • there are many different kinds of living things including plants, animals, microorganisms • all living things can carry out all the seven life processes: nutrition (feeding), growth, reproduction, respiration (energy production), excretion, sensitivity (to the environment), movement	• **describing** the components of Earth's biospheres • **identifying** living organisms found in each sphere • **describing** conditions that sustain life	• Textbooks and other reference materials • Pictures and/ or video clips of Earth and its biosphere
		Requirements for sustaining life • living things need energy, gases, water, soil and favourable temperatures • living things are suited (adapted) to the environment in which they live, such as fish have fins to move easily through water	• **investigating** requirements (such as light, water) for the growth of seedlings *[germinate seeds and grow the seedlings under different conditions]*	• Seeds, soil and containers to grow seeds, rulers or measuring tapes
3 ½ weeks	**Biodiversity**	**Classification of living things** • plants, animals and microorganisms, and their habitats make up the total biodiversity of the Earth • living organisms are sorted and classified according to their shared characteristics • scientists have grouped the organisms into a classification system • the five main groups (called Kingdoms) of living organisms include Bacteria, Protista, Fungi, Plants and Animals • basic differences in processes such as movement, nutrition and reproduction, distinguishes plants from animals • Kingdoms are further subdivided into Phyla/Divisions, then Classes, then Families, then Orders, then Genera, and the smallest group is Species	• **grouping** a selection of everyday objects according to observable features, for example shape, colour, size, and use • **drawing** up a table of the basic differences between plants and animals • **sorting** vertebrates and invertebrates using observable characteristics	• Selection of pictures, photographs or drawings of vertebrates and invertebrates • Magnifying lenses, live or preserved specimens

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Biodiversity *[continued...]*	**Diversity of animals** • animals are classified as either vertebrates (animals with backbones) or invertebrates (animals without backbones) • vertebrates are subdivided into five classes on the basis of distinguishing characteristics: - Fish - Amphibians - Reptiles - Birds - Mammals • invertebrates are subdivided into the Phyla Arthropoda and Mollusca, on the basis of distinguishing characteristics • arthropods have a hard outer covering (exoskeleton) and jointed legs, such as Insects (locust), Arachnids (spider), Crustaceans (crab) • Molluscs are soft bodied animals such as snails *[**Note**: Classification of all of the invertebrates is not required]* **Diversity of plants** • plants are classified as plants with seeds (such as maize) or plants without seeds (such as ferns) • plants with seeds are Angiosperms (flowering plants) and Gymnosperms (cone bearing plants such as the cycad) • plants can produce their seeds in flowers (Angiosperms) or in cones (Gymnosperms) • Angiosperms consist of two major groups, dicotyledons and monocotyledons. These groups differ with respect to their roots, stems, leaves, flowers, fruits and seeds *[**Note:** Emphasise local and other South African examples]*	• **listing** the distinguishing characteristics of the 5 classes of vertebrates • **listing** the distinguishing characteristics of the 4 groups (Classes/Phyla) of invertebrates **observing and describing** the land snail • **identifying and describing** the observable differences between - Angiosperms and Gymnosperms - monocotyledons and dicotyledons	• Reference materials • Selection of plants collected in and around the school property • Magnifying lenses • Live or preserved specimens

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
3 ½ weeks	**Sexual reproduction**	**Sexual reproduction in Angiosperms** • seeds are produced in flowers, which are the sexual organs of Angiosperms • the components of a flower usually include: - male structures called stamens for producing pollen (containing male sex cells) - female structures called stigma (for receiving pollen), style and ovary (for producing female sex cells) - petals (for attracting pollinators) - sepals (for protecting the flower bud) • pollination and fertilisation are essential processes for flowers to produce seeds • pollination is the transfer of pollen between plants of the same species for the purpose of fertilisation • wind and water can facilitate pollination • pollination can also be aided by pollinators such as insects, birds, mammals • flowers have special *adaptations* to promote pollination, such as large colourful petals, scent and sweet nectar to attract insects and birds • pollinators play an important role in the production of food crops (such as maize) for humans • fertilisation is the fusion of the male and female sex cells to produce seeds • during fertilization the following happens: each mature pollen grain contains two male sex cells. When the pollen attaches to the stigma of a flower from the same species, the pollen produces a pollen tube, which grows down the neck of the style, transporting the male sex cells to the ovule. Within the embryo sac of the ovule, one male sex cell fertilizes the egg, which develops into a seed. The other male sex cell unites with two cells in the embryo sac and this results in the development of the endosperm, the starchy food that feeds the developing seed. The ovary enlarges and becomes a fruit. • the seeds are contained in fruit • fruits and seeds are dispersed in various ways	• **growing** plants such as beans or maize seeds to observe the stages in the life cycle. Measure the height of the plant as it grows. Record observations in diagrams, tables and graphs • **identifying, drawing and describing** the components of a flower • **comparing** the structure of a variety of flowers, and the methods of pollination • **describing** how flowers are adapted to promote pollination • **describing** different fruit, seeds and the method of seed dispersal	• A variety of plant specimens • Soil • Containers to grow plants • Seeds (such as beans and maize) • Rulers or measuring tapes

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Sexual reproduction *[continued...]*	**Human Reproduction** • the main purpose of reproduction is for the sperm (male sex cell) and egg (female sex cell) to combine, develop and produce a baby • puberty is the stage in the human life cycle when sexual organs mature for reproduction • humans also experience drastic physical and emotional changes during this stage • the male reproductive organs include the penis and the testis (produces sperm cells) • the female reproductive organs include the vagina, uterus, ovaries (contain egg cells/ ova) • fertilisation is a process when the sperm fuses with the egg • the uterus develops a thick layer of blood in preparation for a fertilised egg • if fertilisation does not take place, menstruation occurs. The thick layer of blood breaks down and is released through the vagina • if fertilisation takes place, the fertilised egg is embedded (implanted) in the blood lining of the uterus. This leads to pregnancy • pregnancy can be prevented by using contraceptives such as condoms to prevent the sperm reaching the egg • condoms also prevent the transmission of HIV/AIDS and other STDs (sexually transmitted diseases), if used effectively *[**Note:** It is important that learners understand that early sexual activity can have serious consequences. Learners need to know enough about this topic to be able to make informed decisions and responsible choices]*	• **drawing** a personal time line and locating puberty • **discussing** and writing about the changes experienced during puberty • **discussing and writing** about responsible sexual behaviour • **discussing** myths about menstruation and sex	

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
1 week	**Variation**	**Variations exists within a species** • a species is a category within the classification system. Living things of the same type belong to the same species. For example, humans are one species and dogs are another species • individuals of the same species can reproduce to make more individuals of the same species • all people are human *(Homo sapiens)* and belong to the same species • differences between living things of the same species is called variation • variation amongst humans can be inherited. Some inherited characteristics are height and tongue-rolling	• **measuring and collecting** information (data) about the height of learners in the class. Show the results as a bar graph - collecting information (data) about the height of adults in the immediate family of the learners - correlating the height of their family members with the height of learners in the class • **recording** information about how many learners are able (or not) to roll their tongues - **calculating** the percentage of learners in the class who are able to roll their tongues - **recording** information about tongue rolling amongst members of the families of the learners - **calculating** the percentage of family members in a family who are able to roll their tongue or not • **discussing** about careers in the chemical industry, including agriculture, pharmacy or the food industry, chemical engineering, mining *[not for assessment purposes]*	
Assessment guidelines	This content and the associated concepts must be integrated with the aims and skills for Natural Sciences *(refer to **Section 2**)*. • Learners should read, write, draw and do practical tasks regularly • Evidence of learner's work, including assessments, should be kept in the learner's notebook School-based assessment (including practical tasks and class tests), checking for correctness, and providing constructive feedback should be done regularly. Allow for a maximum of 6 hours to be used for assessment throughout the term. For more detailed guidelines on assessment, *refer to **Section 4.***		**Check the learner's knowledge and that they can**: • describe conditions that support life • name the different components of the biosphere • sort plants and animals into groups based on observable similarities • give the distinguishing characteristics of the five vertebrate classes • give the distinguishing characteristics of the selected invertebrates • name, describe and provide the function of the components of the flower • distinguish between pollination and fertilization • relate the structure with the function of the reproductive organs of humans • define the terms puberty, menstruation, fertilization, pregnancy and contraception • link the presence of differences between living things of the same species to variation	

GRADE 7 TERM 2				
STRAND: MATTER AND MATERIALS				
TIME	**TOPIC**	**CONTENT & CONCEPTS**	**SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS**	**EQUIPMENT AND RESOURCES**
2 weeks	**Properties of materials**	**Physical properties of materials** • properties of materials determine their suitability for a particular use such as: *(refer to Grade 5 Energy & Change)* - strength - flexibility - boiling and melting points - electrical conductivity - heat conductivity • the boiling point of a substance is the *temperature* at which the liquid starts boiling (boiling is a rapid change in state from a liquid state to a gas state) • other factors (such as cost, colour and texture) are also taken into account when using materials **Impact on the environment** • the production and/or use of materials such as metals, plastics and fuels has an impact on the environment	• **investigating and comparing** the strength of selected materials *[by dropping weights onto, or hanging weights on materials such as different shopping bags, aluminium foil, newspaper, photocopier/printer paper, plastic wrap, wax paper]* • **reading** about the boiling and melting points of different materials such as salt, water, ethanol, paraffin, iron, copper, gold, silver, lead • **investigating** what happens when water heats up and boils *[heat water and take the temperature reading every 3 minutes until the temperature reading becomes constant for three readings]*. Record time intervals and temperature readings in a table, and draw a line graph *[**Note:** you can do the same with other liquids such as orange juice, apple juice, cola]* • **reading and writing** about how a material such as a metal or plastic or fuel is produced and its impact on the environment	• Textbooks • Selection of materials for example: Paper, cardboard, copper wire, wood, rubber, plastic, stone/clay, brick, glass, aluminium foil, wax paper, rope/string • Heat sources • Tripod stands, gauze and glass containers • Thermometers
2 weeks	**Separating mixtures**	**Mixtures** • a mixture is made up of two or more substances or materials that have different physical properties. Where the properties differ, the substances can be separated **Methods of physical separation** • the physical properties of the materials in a mixture determine the separating method to be used • some methods used to separate materials include hand sorting (separating sheep wool from thorns), sieving (separating stones from sand), filtration (separating sand from water) *(refer to Grade 6 Matter & Materials)*	• **designing and explaining** about the best ways to separate and collect all the materials from a mixture of sand, iron filings, salt, ethanol and water. Explain why you have chosen each method of separation • **demonstrating** distillation by using a Liebig condenser or any other suitable apparatus • **separating** ink by chromatography *[use black ballpoint ink (or other koki colours), white paper strips and methylated spirits as a solvent]*	• Sieves • Filter paper • Funnel • Glass or plastic jars

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Separating mixtures *[continued...]*	**Methods of physical separation** *[continued...]* • additional methods include - using a magnet (separating iron from sand) - evaporation (retrieving salt from sea water) - distillation (retrieving pure water from sea water). Distillation always involves boiling and condensation *[change from gas to a liquid]* - chromatography (separating different colour pigments from one colour pigment, such as black **Sorting and recycling materials** • it is every person's responsibility to dispose of waste in a proper way • only certain materials are suitable for recycling, such as metals, plastics and glass. Organic waste can be made into compost. Material which cannot be recycled has to be dumped • local authorities have systems for sorting and disposing of waste materials • there are negative consequences associated with poor waste management such as pollution of water, soil and the environment; health hazards and diseases; blockage of sewage and water drainage systems; waste of land used for landfills; wastage of valuable materials which could be recycled	**discussing** about the many careers in chemistry, mining, waste management [*not for assessment purposes]*	• Magnets • Iron or metal filings (or coins) • Sugar/salt • Heat source • Liebig condenser (if available) or test tubes, stoppers and glass and rubber tubes • Black ink • Koki colours • Methylated spirits
2 weeks	**Acids, bases and neutrals**	**Tastes of substances** • the human tongue can sense four different tastes, salty, sweet, sour and bitter *[There is a survival advantage to being able to distinguish these tastes, such as selecting a ripe apple which usually tastes sweet, but discarding an unripe one which tastes sour]* *[**Note**: not all substances are safe to taste]* **Properties of acids, bases and neutrals** • acids and bases are an important group of chemicals • many foods and household chemicals can be classified as acids, bases, or neutrals depending on their properties	• **investigating** common beverages to determine whether they are acids, bases or neutrals (such as water, tea and rooibos, coffee, milk, fruit juices, fizzy drinks) to test whether they are acids, bases or neutrals • **using** red and blue litmus paper. Record results on a table and draw conclusions	• Red litmus paper • Blue litmus paper • Glass containers • Liquids such as: tea, rooibos, coffee, milk, fruit juices, fizzy drinks, • Household substances such as: vinegar, tartaric acid, lemon, antacids, shampoo, soap, bicarbonate of soda, liquid soap

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Acids, bases and neutrals *[continued...]*	**Properties of acids, bases and neutrals** *[continued...]* • acids (such as lemon and other fruit juices, vinegar, tartaric acid, swimming pool acid) have the following properties - taste sour - feel rough on the skin - many are dangerous to taste or feel (are corrosive) • bases (such as bicarbonate of soda, washing powder, most soaps, bleach and household cleaners) have the following properties - taste bitter - feel slippery on the skin - many are dangerous to taste or feel (are corrosive) *[soluble bases are called alkaline/s]* • neutrals (such as pure water, salt solution, sugar solution, cooking oil) are neither acids nor bases **Acid-base indicators** • red and blue litmus paper can be used to test/indicate whether a substance is an acid, a base or a neutral - red litmus paper remains red in an acid and a neutral, but turns blue in a base - blue litmus paper remains blue in a base and a neutral, but turns red in an acid • we always use *both* red and blue litmus to test a substance	• **investigating** a range of household substances (such as vinegar, tartaric acid, aspirin, antacids, shampoo, soap, bicarbonate of soda, salt water, sugar water, liquid soap) to test whether they are acids, bases or neutrals using red and blue litmus paper. Record results on a table and draw conclusions *[Detergents/soaps are expected to test basic, but some have additives such as lemon juice and therefore may test acidic instead. Check on packaging labels]*	

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
2 weeks	**Introduction to the Periodic Table of Elements**	**Arrangement of elements on the Periodic Table** • the Periodic Table of Elements is a classification system for the elements which make up matter and materials in the world *[an element is a pure substance which cannot be broken down further]* • the Periodic Table was devised by Dmitri Mendeleev in the 1860s. He arranged the elements according to their properties in a table format • the elements of the Periodic Table are arranged into three main categories; metals, semi-metals and non-metals: - metals are arranged on the left hand side of the table - non-metals are found on the far right hand side of the table - semi-metals are found in the region between metals and non-metals • each element has its own name, symbol, atomic number and position on the Periodic Table **Some properties of metals, semi-metals and non-metals** • metals are usually shiny, ductile and malleable, solid (except mercury) and have high melting and boiling points • non-metals have a variety of different properties (depending on whether they are solids or gases) • semi-metals are solids and have some properties of metals and some properties of non-metals	• **reading** about and **learning** the names and symbols of the first 20 elements of the Periodic Table *[learners need NOT memorise the atomic number of each element]* • **categorising** the elements in a copy of the Periodic Table by colouring each category (metals, semi-metals and non-metals) in different colours • **identifying** a number of elements from the Periodic Table used in everyday life/ the household. Describe them in writing	• Periodic Tables • Three colours of pencils / crayons
Assessment guidelines	This content and the associated concepts must be integrated with the aims and skills for Natural Sciences *(refer to **Section 2**)*. • Learners should read, write, draw and do practical tasks regularly • Evidence of learner's work, including assessments, should be kept in the learner's notebook School-based assessment (including practical tasks and class tests), checking for correctness, and providing constructive feedback should be done regularly. As this is an exam term, the final two weeks may be required for revision. For more detailed guidelines on assessment, *refer to **Section 4.***For more detailed guidelines on assessment, *refer to **Section 4.***		**Check the learner's knowledge and that they can**: • measure the temperature of water as it heats up to boiling point, draw accurate line graphs, understand and explain the results • explain the separation processes correctly and write about how to separate and collect sand, iron filings, salt, ethanol and water from a mixture • discuss one important consequence of poor waste management for the environment • classify several common beverages/ household substances into acids or bases or neutrals using an indicator • identify metals, semi-metals and non-metals on the Periodic Table of elements	

GRADE 7 TERM 3				
STRAND: ENERGY AND CHANGE				
TIME	**TOPIC**	**CONTENT & CONCEPTS**	**SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS**	**EQUIPMENT AND RESOURCES**
1 week	**Sources of energy**	**Renewable and non-renewable sources of energy** • energy is needed to make everything work, move or live • a source of energy has energy stored waiting to be used, or energy that is needed to make something happen - non-renewable sources of energy cannot be replenished once used, such as fossil fuels (coal, oil, natural gas) and nuclear fuels (such as uranium) *[Links to Planet Earth and Beyond Grade 7 term 4]* - renewable sources of energy are continually replenished, such as hydro power, wind, sunlight, biofuel (wood)	• **listing** non-renewable energy sources. Explain why they are regarded as non-renewable • **listing** renewable energy sources. Explain why they are regarded as renewable	• Textbooks and reference materials • Pictures and reading texts about non-renewable and renewable sources of energy
2 weeks	**Potential and Kinetic Energy**	**Potential energy** • potential energy is energy that is stored in a system, such as in a stretched rubber band, a weight balanced on the edge of a table, a cell (battery), fuel • there is also potential energy in food [all energy is measured in a unit called the joule (J)]. The energy content in foods is usually labelled on food packaging *[**Note**: definition and calculation of joules is NOT required]* **Kinetic energy** • kinetic energy is the energy that a body has when it is moving, such as when a rubber band snaps back, a weight falls off a table, wind blows, water falls, a vehicle moves, current flows through a circuit (electricity) **Potential and kinetic energy in systems** • potential and kinetic energy are involved in - mechanical systems - thermal (heating) systems - electrical systems - biological systems *[a system is a set of parts working together]*	• **finding** the energy content in different foods, by reading the labels on food packaging • **investigating** energy transfers in - mechanical systems (such as - scissors cutting paper, a bent ruler can flick a pellet across the classroom, cricket ball hit by a bat) - thermal systems (such as - a candle heating cold water in a can, a cup of tea losing heat to the surroundings) - electrical systems (such as - a cell/ battery in a circuit can activate a motor, buzzer or a small torch bulb) - biological systems (such as - a horse eats a plant and can move or pull a cart, energy being passed along a food chain)	• Rubber bands • Various food packaging with labels showing energy content • Cells (batteries)

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Potential and Kinetic Energy *[continued…]*	**Law of conservation of energy** • energy can neither be created nor destroyed but can be converted from one form to another • energy can be transferred in a system when different parts of the system interact with one another and cause changes *[Approach should be to provide learners with examples rather than a definition]* • energy can also be transferred from one system to another such as from an electrical system to a mechanical system in a motor	• **comparing** features of these systems, and observing the effects of energy transfers in the different parts and describing: - where the input energy comes from - where the energy goes (transfer) - the energy changes (in terms of potential and kinetic energy) observed in the system • **recording** observations in a flow diagram using arrows to show how energy is changed as it is transferred	• Scissors, paper, rulers • Candles, cans • Cells (batteries), conducting wire, motors, torch bulbs, buzzers
2 weeks	**Heat transfer**	**Heating as a transfer of energy** • heating is a process in which energy is transferred from a hotter body to cooler body • the energy transfer continues until both bodies are at the same temperature • heat is transferred in three ways by: - conduction - convection - radiation **Conduction** • is the transfer of heat between solid objects that are in direct physical contact with each other • heat "travels" from the source of heat through the object, or from one object to another by conduction • metals are conductors of heat. Some metals conduct heat better than others • good conductors are used for making things such as cooking pots • other materials prevent/slow down conduction of heat, and are called insulators of heat (such as plastics and wood). These are generally poor conductors of heat	• **investigating** heat conduction using various metals such as aluminium, steel, brass, iron rods and compare their rates of conduction. Identify variables that could affect the findings. *[attach a pin to one end of each rod with Vaseline. Heat the other end of the rod in a bath of hot water and record the time of how long it takes for the pin to fall off]* - draw a bar graph to show the results	• Video clips from the internet to show conduction, convection and radiation • Spirit / Bunsen burner • Steel, brass, aluminium and Iron rods • Styrofoam • Wood • Plastic • Wax or Vaseline • Drawing pins • Heat conducting tins (if available) • Wrist watch with a second hand / Stopwatch

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Heat transfer *[continued…]*	**Convection** • is the transfer of heat from one place to another by the movement of liquid or gas particles - air and water expand when heated and the particles move upwards. When cooled they move down again. This is called a convection current **Radiation** • radiation is the transfer of heat and does not require physical contact or movement of particles • the heat from the Sun travels mainly by radiation across empty space to the Earth • shiny surfaces (such as silver) are good reflectors of radiant heat and dark surfaces (such as black) absorb heat energy *(links to Light in Grade 8 and FET)* • radiation heats up dark surfaces more quickly (absorb heat) than it heats up shiny surfaces (reflect heat)	• **demonstrating** convection currents in water in a transparent container • **drawing and labelling** to explain why heaters are best placed near the floor and air conditioners are best placed near the ceiling • **demonstrating** heat energy transfer through radiation using a candle • **investigating/demonstrating and measuring** the amount of radiant heat absorbed using dark coloured (matt black), light coloured (white, yellow) and shiny (silver) surfaces *[make envelopes of different coloured paper and aluminium foil, insert thermometers, place in the Sun and measure the temperature increase over time].* - draw a line graph to show the results	• Food colouring or crystal of potassium permanganate • Glass/transparent plastic container • Candles • Shiny silver surfaces (wrapped by aluminium foil) • Matt black surfaces (painted matt black) • Thermometers • Cardboard or paper and glue
2 weeks	**Insulation and energy saving**	**Using insulating materials** • heat can be 'lost' through conduction, convection and radiation from our bodies and objects such as electric geysers, • heat can also be gained through radiation, conduction and convection, for example in solar water heaters • people use insulating materials to help minimise heat loss in winter or heat gain in summer • insulating materials slow down heat transfer (heat loss or gain) through conduction, convection and radiation. Insulators are used - for making things such as "cool boxes" - in the ceilings of buildings, - for clothing (such as coats, jerseys, woolly hats) and blankets • conservation of heat energy in homes and buildings can be improved by minimising heat loss in winter and heat gain in summer • many indigenous, traditional homes and technologies in South Africa are designed for our climate and to be energy efficient	• **explaining** how a solar water heating system works, in terms of radiation, conduction and convection *[use real examples, pictures or diagrams]* • **investigating** different insulating materials (such as styrofoam, newspaper, plastic, glass) by how well they keep hot objects hot (such as a cup of tea) or prevent cold objects (such as ice) from heating up. Measure temperature loss or gain and record results. Sequence the insulators from very good to poor • **designing, making and testing** a system ("hot box/ wonder box") which uses insulating materials to keep food hot for longer or to keep ice cold - measure temperature change after some time. Record results and draw a line graph ***OR*** - designing, making and testing a model of a well-insulated house to minimise heat loss	• Pictures /diagrams of solar water heaters • Video clips from internet • Thermometers • Insulating materials such as styrofoam, newspaper, plastic and glass containers, ice • Cooking pot (or container), cardboard box to make a 'hotbox', insulation materials such as paper, fabric, cushions, blankets • Materials to build a model of a house • Insulating materials

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
1 week	**Energy transfer to surroundings**	**Useful and 'wasted' energy** • systems such as appliances, tools, vehicles, machines provide useful energy outputs • some energy that is transferred in a system can escape to the surrounding environment as 'wasted energy' • the output energy in a system is always less than the input energy, because some of the energy escapes to the surroundings • 'wasted' energy can escape in the form of heat and/or sound - sound is an example of 'wasted' energy in an electric drill, food processor, hair dryer - heat is an example of 'wasted' energy in a candle, lamp, engine	• **researching** the waste of energy from different machines and appliances such as - a car which wastes about 65% of the energy from fuel in the form of heat - a power station which wastes about 50% of the energy from burning coal, to the surroundings • **identifying** the input energy, useful output energy and 'wasted energy' when systems are operated. *[Use real examples or pictures of systems such as electric drill, electric iron, kettle, food mixer, candle, engine, paraffin lamp]*	• Pictures or examples of tools/ appliances such as electric drill, electric iron, kettle, food mixer
1 week	**The national electricity supply system**	**Energy transfers in the national grid** • the national electricity grid is a system (circuit) • the electricity is supplied in the following sequence - energy from sources such as coal, oil, gas, nuclear fuels, falling water and wind, is transferred to turbines - turbines transfer energy to a generator - a generator changes energy from mechanical movement into electricity and transfers the electricity into the wires of the national electricity supply grid - the wires transfer energy to the electrical appliances and lights • dynamos are small generators, which also change energy from mechanical movement to electricity • dynamos are used in some bicycle lights and mine helmets, and in wind-up torches and radios	• **interpreting** diagrams or pictures of the national electricity grid; from the power station to the consumer. Explain the energy transfers	• Pictures of how electricity is generated in the power station, to the wires of the supply grid, to the electrical appliances in the home • Video clips from the internet • A dynamo (or pictures of how they are used)

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	The national electricity supply system *[continued…]*	**Conserving electricity in the home** • South Africa has a limited supply of electrical energy • there are many different ways to use energy wisely and to save energy at home: by turning off lights and appliances, using energy saving light bulbs, wearing warm clothing, stopping cold draughts, using energy efficient appliances, matching pot size to stove plate and using a "hotbox" for cooking	• **suggesting and writing** about ways to conserve energy in the home/school/community • **discussing** about careers in the field of electricity power generation (coal, nuclear, wind, water) including engineers, scientists (research), artisans, technicians *[not for assessment purposes]*	
Assessment guidelines	This content and the associated concepts must be integrated with the aims and skills for Natural Sciences *(refer to **Section 2**)*. • Learners should read, write, draw and do practical tasks regularly • Evidence of learner's work, including assessments, should be kept in the learner's notebook School-based assessment (including practical tasks and class tests), checking for correctness, and providing constructive feedback should be done regularly. Allow for a maximum of 6 hours to be used for assessment throughout the term. For more detailed guidelines on assessment, *refer to **Section 4.***		**Check the learner's knowledge and that they can**: • distinguish between renewable and non-renewable sources of energy and give examples of each • compare potential and kinetic energy • describe the input energy and trace and record the transfer and changes of energy through various energy transfer systems • describe and demonstrate the difference between conduction, convection and radiation • show how to use insulating materials to minimise heat loss or heat gain • identify and describe ways to conserve energy in the home/school/community	

GRADE 7 TERM 4				
STRAND: PLANET EARTH AND BEYOND				
TIME	**TOPIC**	**CONTENT & CONCEPTS**	**SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS**	**EQUIPMENT AND RESOURCES**
4 weeks	**Relationship of the Sun to the Earth**	**Solar energy and the Earth's seasons** • the Sun radiates heat and light in all directions • the Earth receives energy from the Sun in the form of heat and light (solar energy) • the Earth spins on its axis once per day • the Earth's axis is an imaginary line that goes through the centre of the Earth from the north pole to the south pole • the Earth's axis is not vertical, it is tilted from the vertical by an angle of 23,5º • the tilt of the Earth's axis does not change as the Earth orbits around the Sun • due to the tilt of the Earth, the intensity of the solar energy (amount per unit area) that reaches different parts of the Earth changes through the year • differing intensities of solar energy reaching the southern and northern hemispheres through the year lead to the four seasons • when the solar energy falls more directly on the southern hemisphere, the solar energy is spread over a smaller area and it is summer in the southern hemisphere • when the solar energy falls obliquely (at an extreme angle) on the southern hemisphere, the solar energy is spread over a wider area and it is winter in the southern hemisphere • the length of the day also depends upon the season. In summer, days are longer than in winter. This is also caused by the tilt of the Earth's axis.	• **making** a model of the globe using a ball showing the south and north poles, the equator and the southern and northern hemispheres • **demonstrating** the passage of the Earth around the Sun. [*A learner can hold a torch (for the Sun) and another learner can carry the globe at its tilt]* • **drawing and labelling** diagrams to show the tilt of the Earth and the direct and oblique rays of sunlight energy that cause the four seasons	• Textbooks and reference materials • Globe / ball • Torch • Pictures and video clips from the internet of the Sun and showing: - the Earth's passage around the Sun - the changing amounts of solar energy reaching different parts of the Earth through the year
		Solar energy and life on Earth • plants absorb light from the Sun and produce energy-containing food *(refer to Grade 8)* • all plants and animals depend on this process for their energy *(refer to Grade 8)* • the Sun's energy sustains all life on Earth		• Pictures and video clips from the internet of - the Sun and - how coal, oil and gas are formed from the Sun's energy

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Relationship of the Sun to the Earth *[continued...]*	**Stored solar energy** • dead plants and animals can eventually form coal, oil or gas (fossil fuels) after millions of years • this happens when: - the remains of dead plants and animals are covered by layers of mud and soil - the layers press down on these remains - more layers lead to increased pressure - increased pressure, over long periods of time, changes these remains into coal, oil or gas	• **drawing** a diagram which shows the flow of energy from the Sun through to the formation of fossil fuels like coal, oil and gas.	
		• the coal, oil and gas store energy from the Sun that was absorbed by plant s millions of years ago • humans are using this store of energy (coal, oil and gas) faster than it is being formed (non-renewable resource)	• **drawing, labelling and writing** to explain the sequence of processes and events that lead to the storage of energy from the Sun in coal, oil and gas	
2 weeks	**Relationship of the Moon to the Earth**	**Relative positions** • the Moon revolves around the Earth in its orbit **Gravity** • gravity is the tendency of all objects to attract (pull) each other • the pull of gravity depends on how much mass each object has and how far apart they are - more massive objects exert a stronger pull than smaller objects over the same distance - for objects of the same mass, the closer they are to each other, the stronger is the pull of gravity between them • the Earth is held in its orbit around the Sun by the pull of the Sun's gravity • the Moon is held in its orbit around the Earth by the pull of the Earth's gravity • the Moon also has its own gravity	• **demonstrating** the pull of gravity by swinging a ball attached to rope or string in a circular motion	• Ball and rope or string • Video clips from the internet showing: - the Moon in orbit around the Earth - the Moon's gravity results in ocean tides on Earth - Full Moon and New Moon cause spring tides

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Relationship of the Moon to the Earth *[continued…]*	**Tides** • tides are the predictable, repeated rise and fall of sea and ocean levels • tides on Earth are caused mainly by the gravity of the Moon • the gravity of the Moon pulls on the water in the seas and oceans on Earth	• **using diagrams to write and explain** the effects of the Moon's gravity on the Earth showing the tides	
		• this pull causes the Earth to experience high and low tides in the oceans. There are usually two high tides and two low tides over a day and a night • when the Moon is aligned with (in line with) the Sun (at Full Moon and New Moon), the Sun's gravity adds to the Moon's gravity. This causes higher than usual high tides and extra-low low tides (spring tides)		• Pictures and texts about shoreline ecosystems
		• tides sustain unique shoreline ecosystems between the high and low water levels *[an ecosystem is a community of living organisms and their interaction with the environment]*	• **writing** to explain the effects of the Moon's gravity on ecosystems on Earth	

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
2 weeks	**Historical development of astronomy**	**Early indigenous knowledge** • the Moon and Sun and stars seem to move in predictable patterns • people observed these patterns and used them to measure time and develop different calendars - a year (a time period that includes the four seasons) - a month (a time period from one full moon to the next full moon) - a day (a time period from one sunrise to the next sunrise) • people used these patterns in different ways such as to denote a time for planting, finding direction and special holy days • people passed this knowledge on using stories	• **writing** about traditional cultural interpretations and stories about the Sun, Moon and patterns in the sky	
		Modern developments • people have made and continue to make important discoveries in astronomy • Copernicus suggested that the Sun is at the centre of the Solar System (1514) • Galilei made the first telescope to observe planets and their moons (1610) • Kepler used mathematics to describe orbits accurately (1609) • Newton showed that gravity held the Solar System together (1687)	• **researching and writing** about a significant discovery in astronomy	• Reference materials on significant discoveries relating to astronomy
Assessment guidelines	This content and the associated concepts must be integrated with the aims and skills for Natural Sciences *(refer to **Section 2**)*. • Learners should read, write, draw and do practical tasks regularly • Evidence of learner's work, including assessments, should be kept in the learner's notebook School-based assessment (including practical tasks and class tests), checking for correctness, and providing constructive feedback should be done regularly. As this is the exam term, the final two weeks may be required for revision. For more detailed guidelines on assessment, *refer to **Section 4.***		**Check the learner's knowledge and that they can**: • demonstrate the Earth's tilt as it orbits around the Sun • describe the relationship between solar energy, the Earth's movement around the Sun and the seasons • demonstrate their understanding of how coal, oil and gas are formed in the Earth, starting from the Sun's energy • explain the effects of the Moon's gravity on the Earth, including tides and ecosystems • discuss significant events around the development of knowledge of astronomy	

GRADE 8 TERM 1				
STRAND: LIFE AND LIVING				
TIME	**TOPIC**	**CONTENT & CONCEPTS**	**SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS**	**EQUIPMENT AND RESOURCES**
2 weeks	**Photosynthesis and respiration**	**Photosynthesis** • interactions and interdependence in an ecosystem are driven by the need for energy to sustain life • the Sun is the important source providing this energy in the form of light and heat • plants use carbon dioxide (from the air), water (from the soil) and energy from the Sun in a series of chemical reactions to produce glucose (food). This process is called *photosynthesis* • oxygen gas is released into the air as a by-product $carbon\ dioxide + water \xrightarrow[sunlight]{chlorophyll} glucose + oxygen$ *[No further details are required]*	• **writing** about the requirements for, and products of photosynthesis	• Textbooks and other resource materials
		• plants change glucose into starch, cellulose and other chemical compounds to enable processes such as growth and reproduction **Respiration** • food contains energy (potential energy). This energy can be released from food by a series of chemical reactions. This process is called *respiration* • *respiration* (in all living organisms) is the process by which energy is released from food in a series of chemical reactions $glucose + oxygen \longrightarrow energy + carbon\ dioxide + water$ *[No further details are required]*	• **conducting** an investigation to show that leaves produce starch *[soak the leaf in boiling water, extract chlorophyll using ethanol/methylated spirits, add a few drops of iodine solution].* Write a report using the headings; aim, hypothesis, method, results, conclusion and discussion • **writing** about the requirements for, and products of respiration • **testing** for the presence of carbon dioxide in exhaled air using clear lime water	• A variety of leaves • Heat source / spirit or Bunsen burners • Glass containers/ test tubes • Ethanol/ methylated spirits • Iodine solution • White surfaces • Slaked lime (to make lime water) • Drinking straws

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
5 weeks	**Interactions and interdependence within the environment**	**Introduction to ecology** • ecology is the study of interactions of organisms with one another and with the physical and chemical environment • scientists usually classify the study of ecological interactions into four levels; populations, communities, ecosystem and the biosphere **Ecosystems** • all ecosystems combined make up the biosphere • an ecosystem consists of an ecological community that includes all living organisms (biotic) such as plants and animals, together with the non-living (abiotic) environment such as temperature, wind, water, interacting as a system • the size of an ecosystem is not specifically defined and it usually encompasses a specific, limited area (although it can encompass the entire planet) • ecosystems are defined by the network of interactions among organisms, and between organisms and their environment • survival of individual organisms and populations depends on the its ability to cope with changes (adapt) in its habitat (the place where an organism lives) or in the ecosystem	• **listing** abiotic and biotic factors in an ecosystem • **selecting** and marking off an ecosystem - identify and describe the abiotic aspects of the ecosystem such as amount of sunlight, water, wind, temperature, soil type and slope of the area • **selecting** and marking off an ecosystem *[continued...]* - describe how the abiotic factors of the ecosystem affect the plants and animals - identify, count and describe the plants and animals (biotic factors) in the ecosystem - describe the relationship between the biotic factors (such as feeding and shelter) in the ecosystem - identify any human interferences in the area (such as litter and pathways) - study a small sample of the soil in the ecosystem marked, using a hand lens, and identify any remains of dead plants and animals	• Pictures of different ecosystems (large and small) showing the living and non-living components • Thermometers • Hand lenses • String (for making quadrats) • Rulers/meter sticks • Sieves • Hand lenses • Field guides for identifying plants and animals

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Interactions and interdependence within the environment *[continued...]*	**Feeding relationships** • plants are *producers*. They make their own food • animals are *consumers*. They obtain food from plants either directly (such as herbivores) or indirectly (such as carnivores) • *herbivores:* feed on plant material (for example cows, horses) • *carnivores:* feed on other animals (living or dead). The group includes: - those that hunt other animals (*prey*) are *predators* (for example leopards) - those that eat dead animals are *scavengers* (for example hyenas, vultures) - *insectivores* feed mainly on insects and other smaller invertebrates such as worms (for example earthworms) • *omnivores:* feed on plants and animals (for example humans) • *decomposers*: breakdown (decompose) the remains of dead plants and animals. They recycle important nutrients in the environment (for example bacteria, fungi, earthworms)	• **classifying** selected examples of organisms into their respective feeding groups (such as cows are herbivores)	• Pictures of different local/ South African organisms • Video clips

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Interactions and interdependence within the environment *[continued...]*	**Energy flow: Food chains and food webs** • plants (and algae) play an important role in the ecosystem, as they capture energy from the Sun by the process of photosynthesis • this energy is passed along a food chain from producers to consumers; decomposers are the last link in this transfer of energy and release energy as heat to the environment • each stage of a food chain is called a *trophic level* • energy transfer and energy loss occur at each trophic level • interlinked food chains together form food webs **Balance in an ecosystem** • an ecosystem can only accommodate as many organisms as its resources (food, water and shelter) can carry, and it will fail if it does not remain in balance • this balance can be disrupted by natural and human factors - natural factors include extreme changes in patterns of weather and climate, such as floods, drought, extreme and sudden changes in temperatures - human factors include removing organisms from the ecosystem (such as poaching), human induced pollution • these factors can contribute to an imbalance in an ecosystem, seriously impacting on its components and altering its nature **Adaptations** • adaptation is the change in the structural, functional and behavioural characteristics of an organism • adaptation allows the organism to survive as it adapts to changing conditions within the environment • organisms that are unable to adapt to changes within the environment die out (become extinct) **Conservation of the ecosystem** • environmentalists and others work towards managing ecosystems, such as control of alien vegetation and preservation of wetlands • individuals can contribute to conservation in various ways, such as appropriate waste disposal (including recycling, re-using)	• **identifying** a food chain or food web in an ecosystem in or near the school grounds. Record the observations • **writing and drawing** food chains and food webs (linking names with arrows) in different ecosystems • **drawing and analysing** energy pyramids ***[Note**: on average about 10 % of net energy production at one trophic level is passed on to the next level]* • **evaluating** the impact of various factors (such as loss of habitat, loss of species, change of weather or climate) on ecosystems • **evaluating** the impact on a food web when one of the organisms is removed • **drawing** and labelling diagrams of any selected plants, and describe in the labels how they are adapted to their environment • **reading and writing** about how animals are adapted to live in extreme environments (camel and polar bear); how animals are adapted to being good predators (shark and cheetah); and about other animal adaptations such as camouflage and mimicry • **writing** about the importance of maintaining biodiversity and sustainable use of natural resources • **writing** about irresponsible human practices (such as inappropriate waste disposal) and their impact on ecosystems. Suggest possible solutions	• Pictures of plants and animals in different ecosystems, such as forests, oceans, deserts

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
2 weeks	**Micro-organisms**	**Types of micro-organisms** • micro-organisms are living things • they are too small to see with the naked eye *[they can only be seen under a microscope]* • there is a variety of micro-organisms, including Viruses, Bacteria, Protista and Fungi **Harmful micro-organisms** • some micro-organisms cause diseases, such as TB (caused by bacteria), AIDS (caused by HI virus), malaria (caused by a protest) • disease causing organisms are found almost everywhere, such as at ATMs, handrails of staircases and toilets • waterborne diseases (such as cholera and diarrhoea) account for many child deaths • effective methods of preventing the spread of diseases caused by micro-organisms include washing hands and sterilising • modern scientists such as Louis Pasteur play an important role in identifying and developing cures for some diseases **Useful micro-organisms** • some micro-organisms play an essential role in ecosystems, such as decomposing dead plant and animal matter, thereby recycling nutrients in the soil • some micro-organisms are used by people for making certain foods (such as yoghurt) and medicines (such as penicillin)	• **using** hand lenses or micro viewers to examine small objects (such as bread mould, mushrooms, newsprint) to understand the concept of magnification (make bigger in order to see a microscopic object) • **examining and analysing** photographs and/or micrographs of micro-organisms. Use scales to calculate the real size of the organisms • **writing** about the cause, effects, symptoms and treatments of one of the diseases caused by micro-organisms • **discussing** cultural and historical beliefs about diseases caused by micro-organisms • observing micro-organisms by **investigating** the growth of yeast under different conditions *[use different amounts of sugar, different temperatures]* and record observations. Write an experimental report using the headings; aim, hypothesis, method, results, conclusion, discussion and applications • **discussing** about the many careers that require knowledge of environmental studies, nature conservation, zoology, botany, entomology, the study of micro-organisms, including agriculture, food industry, medicine *[not for assessment purposes]*	• Hand lenses or • Bio-viewers
Assesment guidelines	This content and the associated concepts must be integrated with the aims and skills for Natural Sciences *(refer to **Section 2**)*. • Learners should read, write, draw and do practical tasks regularly • Evidence of learner's work, including assessments, should be kept in the learner's notebook School-based assessment (including practical tasks and class tests), checking for correctness, and providing constructive feedback should be done regularly. Allow for a maximum of 6 hours to be used for assessment throughout the term. For more detailed guidelines on assessment, *refer to **Section 4.***		**Check the learner's knowledge and that they can**: • explain photosynthesis and respiration • explain how to test for starch in leaves • explain important concepts related to ecology, such as ecosystems, habitats, communities, populations, species, adaptations, extinctions • distinguish between biotic and abiotic factors of an ecosystem • evaluate disruptions to an ecosystem; giving causes, effects and solutions	

GRADE 8 TERM 2				
STRAND: MATTER AND MATERIALS				
TIME	**TOPIC**	**CONTENT & CONCEPTS**	**SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS**	**EQUIPMENT AND RESOURCES**
2 weeks	**Atoms**	**Atoms – building blocks of matter** • all matter is made up of tiny particles called atoms • an element is made up of atoms of the same kind. For example all the atoms of an element, such as copper, are identical • an element is a substance that cannot be broken down into two or more substances by chemical means (An element cannot be changed into another element by means of a chemical reaction) • atoms of one element differ from the atoms of all other elements • all known elements are listed on the Periodic Table of the Elements		• Textbooks and reference materials • Video clips from the internet showing animations of atoms and molecules
		Sub atomic particles • atoms are made up of smaller sub-atomic particles (protons, neutrons and electrons) • the central region of the atom is called the nucleus • the nucleus is made up of positively charged particles called protons and neutral particles called neutrons • negatively charged particles called electrons move around the nucleus • atoms are neutral because the number of negatively charged particles (electrons) is equal to the number of positively charged particles (protons)	• **making** a 2-dimensional model or drawing of an atom (choose an element from the first 20 elements from the Periodic Table) *[Use beads or dried lentils or dried peas pasted with glue onto a paper plate, to make a basic model of an atom of a selected element. Show protons and neutrons making up the nucleus, and electrons in the space around the nucleus]*	• Beads/ dried lentils or dried peas • Paper plates • Glue

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Atoms *[continued…]*	**Pure substances** • elements and compounds are pure substances **Elements** • an element is a material that consists of atoms of only one kind, such as hydrogen (H), oxygen (O), carbon (C), sodium (Na) and chlorine (Cl) • all known elements are listed on the Periodic Table of Elements. They are limited in number and are the building blocks of millions of compounds • some elements on the Periodic Table of Elements form diatomic molecules for example hydrogen (H_2), nitrogen (N_2), oxygen (O_2), chlorine (Cl_2). These are called molecules of elements • sometimes atoms react together chemically to form molecules of compounds (such as H_2O, CO_2) **Compounds** • a compound is a material that consists of atoms of two or more different elements chemically bonded together, such as water (H_2O), carbon dioxide (CO_2), salt (NaCl) • the atoms in a given compound are always combined/bonded in a fixed ratio such as, in water, where the ratio is always two hydrogen atoms (H) to one oxygen atom (O) • a chemical bond is the force that holds atoms together • compounds [such as water (H_2O), carbon dioxide (CO_2), salt (NaCl)] are formed by chemical reactions • compounds can be broken down in a decomposition reaction into other compounds or their original elements by heating or electrolysis. For example, electrolysis decomposes water (H_2O) to form hydrogen (H_2) and oxygen (O_2) **Mixtures of elements and compounds** • elements and compounds are often found mixed together, such as in air, sea water, rocks, and in living things • mixtures are separated by physical means; compounds can be separated by chemical means	• **making** models showing the atoms which make up molecules (such as O_2, H_2, N_2, H_2O, CO_2), using plastic "popit" beads or modelling clay or playdough • **demonstrating and recording** observations of how a compound can be broken down into elements by electrolysis - copper(II) chloride ($CuCl_2$) solution decomposes to form copper (Cu) and chlorine (Cl_2) *[use carbon electrodes and a power source of about 3 to 9 volts]* **and/or** • **demonstrating and recording** observations of how a compound decomposes into elements by heating - potassium permanganate ($KMnO_4$) to obtain oxygen (O_2) ***[Note:** oxygen is not the only product]*. Test for O_2 ***[Note:** a glowing splint is used to test for the presence of oxygen gas. It re-lights in oxygen gas]*	• Plastic "popit" beads or modelling clay or playdough • Copper(II) chloride • Cell/ battery • Conducting wires • Metal plates (electrodes) • Test tubes or small glass containers • Potassium permanganate • Heat source (such as Bunsen burner or spirit lamp) • Wooden splint • Matches • Small ceramic/ glass dish (heat resistant)

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
5 weeks	**Particle model of matter**	**The concept of the particle model of matter** • atoms and molecules are referred to as particles in the particle model of matter • the particle model of matter is a scientific theory used to explain that all matter (solids, liquids and gases) is made up of particles • these particles are too small to see (in a drop of water there would be many billions of water particles) • the spaces between the particles are empty *[**Note**: these spaces do not contain air, they contain nothing]* • scientists have evidence that suggests that the particles are arranged differently in a solid, liquid and a gas - in a **solid**, the particles o are closely packed in a regular arrangement o do not move around but vibrate against each other o have strong forces holding them together o have small spaces between them • in a **liquid**, the particles - are loosely arranged but still quite close together - can move quite fast and slide past each other - have weaker forces between them - have small spaces between them • in a **gas**, the particles - have no particular arrangement - move very fast - have extremely weak forces between them - have very big spaces between them compared to solids and liquids	• **drawing** diagrams to represent particles in a solid, a liquid and a gas, and explain them in terms of arrangement, movement, forces and spacing using the particle model of matter • **drawing** a table comparing the particles of gases, liquids and solids	

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Particle model of matter *[continued…]*	• diffusion is a process in which particles in liquids and gases move (separate and spread) from a highly-concentrated area to an area with a lower concentration of those particles • diffusion is faster in gases compared to liquids *[the concept of diffusion also applies in Life & Living, see Respiratory System Grade 9]*	• **investigating** the rate of diffusion of a gas compared to a liquid relating the speed of diffusion to kinetic energy *[Throw a small amount of ether onto a blackboard; the ether gas diffuses through the classroom quickly. Or diffuse a small amount of potassium permanganate in a large measuring cylinder/glass container of water. It takes a few days for the purple colour to be equally distributed]*	• Ether • Measuring cylinder/large glass jar • Potassium permanganate
		Change of state • heating and cooling can cause a material to change state • the solid material first changes to a liquid (melting) when heated, and then it changes to a gas (evaporating or boiling) on further heating • the gas first changes to a liquid (condensing) when cooled, and then it changes to a solid (freezing or solidifying) when cooled further • as a solid material is heated, the movement of the particles increases which enables them to move past each other and form a liquid • the particles move much further apart from each other when the material changes from the liquid to the gas state	• **investigating** change of state by heating solid candle wax in an empty tin or small tin foil pie dish *[the hot, liquid wax will then solidify if the heat source is removed and it is allowed to cool down]* *[**Note:** do not heat the wax to very high temperatures in order to vaporise it, as the vapour can ignite. If ice is available, it is safer to use. This can be heated to melt the ice and to make the water evaporate or boil]*	• Empty tins • Spirit burners • Foil pie dishes • Tripod stands • Gauze wire mats • Candle wax • Matches
		Density, mass and volume • the density of a material describes the amount of mass in a given volume of that material **Density and states of matter** • in general, gases are less dense than liquids and liquids are less dense than solids *[water is an exception as ice is less dense than water and therefore it floats]*	• **finding** objects with same volume but with different mass and compare them (by hand) in terms of their density, such as sponge, polystyrene, wooden and metal blocks of the same size	• Sponge, • Polystyrene • Wooden and metal blocks of the same size

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Particle model of matter *[continued…]*	**Density of different materials** • some materials have low density and some have high density. For example a loaf of bread has a lower density than a clay brick of the same size • the individual particles making up one material may have different masses compared to the individual particles making up another material. In addition, there are spaces between the particles • the density of a material will depend on the kind of particles it is made up of and the size of the spaces between them	• **comparing** the densities of different materials (by hand) using identical paper/plastic cups full of air, water, sand, flour ***[Note:** each cup of material will have a different mass to the others, although all are the same volume. This tells us that the materials in the cup are of different densities]*	• Paper / plastic cups (of identical size) • Water, sand, flour
		• a material which has lower density will float on a liquid which has higher density, for example oil (lower density) will float on water (higher density)	• **mixing** oil and water to show that oil is less dense than water and therefore oil floats on the water • **reading** about pollution of water by oil ***[Note:** oil spreads out on top of the water and therefore can pollute a large body of water on the surface]*	• Beakers • Oil and water
		Expansion and contraction of materials • solids, liquids and gases tend to expand when heated and contract when cooled • particles of liquids and gases are in a state of constant motion • as a material is heated, the movement of the particles increases and they move further apart, therefore the material expands • as a material is cooled, the movement of the particles decreases and they move closer together, therefore the material contracts • when a material expands or contracts, the size and number of particles does not change. Instead, it is only the *spaces* between the particles that get bigger or smaller - during expansion, the spaces between the particles get bigger - during contraction, the spaces between the particles get smaller	• **drawing** and explaining how expansion and contraction takes place in terms of the particle model of matter *[use a metal ball and ring apparatus for demonstration]*	• Ball and ring apparatus

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Particle model of matter *[continued…]*	**Pressure** • a gas exerts a pressure because of the collisions of the particles with each other and against the sides of the container • pumping more gas into a container increases the number of gas particles in the container. This increases the number of collisions and therefore increases the pressure *[**Note:** heating also increases the pressure by giving the particles more energy, making them move faster, and collide with greater force. We do not have to deal with this aspect of pressure in this grade]*	• **demonstrating** what happens as we blow up a balloon or pump up a soccer ball or bicycle tyre using a hand pump *[As more air is blown or pumped in, blowing and pumping becomes more difficult]*. Draw and write to explain why it becomes more difficult	• Balloons • Soccer ball • Bicycle tyre • Hand pump
1 week	**Chemical reactions**	**Reactants and products** • substances can react with each other to form products with different chemical properties • in a chemical reaction, the substances that react with one another are called the *reactants* • in a chemical reaction, the substances that are produced are called the *products* of the reaction • in reactions, re-arrangement of the atoms takes place, to form different products • during a chemical reaction, chemical bonds (a bond is a force that holds atoms together) of the reactants break and new bonds form to produce the products • indigenous knowledge includes some examples of useful chemical reactions such as fermentation in brewing [which produces carbon dioxide and ethanol (alcohol)] *[The concept of chemical reactions is developed in Grade 9]*	• **investigating** the chemical reaction that takes place when a whole egg is placed in white vinegar *[the reactants, vinegar and the egg shell (calcium carbonate) react together to produce the products, carbon dioxide gas and a solution (calcium acetate)]*. Make drawings to show what was observed. Show reactants (before) and products (after) the reaction has taken place • **investigating** what happens when you blow with a drinking straw through clear limewater in a beaker/ flask *[the reactants, carbon dioxide and calcium hydroxide react together to form the products, a white suspension of calcium carbonate and water]*. Make drawings to show what was observed. Show reactants (before) and products (after) the reaction has taken place *[This links to Life & Living Grade 9, Respiratory System – lime water test for carbon dioxide]* • **discussing / reading** about careers in inorganic and organic chemistry, mining, engineering, materials development and in the bio-fuels industry *[not for assessment purposes]*	• White vinegar • *Egg* • *Beaker* • Drinking straw • Clear limewater • Beakers / flasks

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
Assessment guidelines	This content and the associated concepts must be integrated with the aims and skills for Natural Sciences *(refer to **Section 2**)*. • Learners should read, write, draw and do practical tasks regularly • Evidence of learner's work, including assessments, should be kept in the learner's notebook School based assessment (including practical tasks and class tests), checking for correctness, and providing constructive feedback should be done regularly. As this is an exam term, the final two weeks may be required for revision. For more detailed guidelines on assessment, *refer to **Section 4***		**Check the learner's knowledge and that they can**: • describe the basic structure of an atom • give examples of molecules of elements and molecules of compounds • explain the difference between elements and compounds, and mixtures and compounds • use the particle model of matter to describe different states of matter and explain change of state, density and pressure • identify reactants and products in a simple chemical equation	

GRADE 8 TERM 3				
STRAND: ENERGY AND CHANGE				
TIME	**TOPIC**	**CONTENT & CONCEPTS**	**SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS**	**EQUIPMENT AND RESOURCES**
1week	**Static electricity**	**Friction and static electricity** • friction (rubbing) between certain materials (such as plastic, perspex, glass, nylon, wool, silk) transfers electrons between the atoms of the two materials being rubbed together • the electrons move from one material causing a positive charge on its surface, and causing a negative charge on the surface of the other material *[It is only the electrons that are transferred, protons and neutrons do not move]* • objects/materials with same/like charges repel each other • objects/materials with opposite/unlike charges attract each other • a discharge of the electrons causes the sparks or shock of static electricity, especially when the air is dry	• **rubbing** a plastic or perspex ruler with a piece of wool or nylon or silk fabric. Bring the ruler close to small pieces of tissue paper or sawdust. Observe what happens and describe in terms of same or opposite charge on the materials ***[Note**: Learners do not need to memorise what charge the materials acquire when rubbed together]*	• Textbooks and reference materials • Video clips from the internet • Plastic or perspex rods or rulers • Pieces of wool/ nylon/silk fabric • Small pieces of paper
3 weeks	**Energy transfer in electrical systems**	**Circuits and current electricity** • a circuit is a system for transferring electrical energy • a closed circuit is needed to make a device work, such as making a bulb light up *(refer to Grade 6 Energy & Change)* • a circuit is a complete conducting pathway for electricity and has a number of components connected together: - from one terminal at the source of energy (cell/battery) à along conducting material (wires) à through the device (filaments of incandescent bulbs) à back to the other terminal of the source of energy (cell/battery) **Components of a circuit** • conducting wires are usually made of metal and carry electricity over a short or long distance • switches provide a convenient way of controlling electrical circuits • cells/batteries are chemical systems that are sources of energy - cells store chemical substances (potential energy) - when the circuit is completed, the chemicals react together to produce an electric current - an electric current is the flow of charges (kinetic energy) along a conductor	• **drawing and interpreting** an electrical circuit diagram and the symbols used in it	• Electrical circuit diagrams

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Energy transfer in electrical systems *[continued…]*	**Components of a circuit** *[continued...]* • **resistors** are made of materials that resist/oppose the flow of electrical current in a circuit - resistors in a circuit have an influence on the amount of electric current flowing in that circuit - some resistors (including bulb filaments, heating wires, elements in kettles/heaters/geysers/stoves) can heat up to provide useful output energy o a light bulb such as a torch bulb, contains a resistance wire called a filament. The filament heats up to be white hot when connected in a circuit. The resistance wire is connected to two contact points - the one end to the screw part (casing) and the other end to the solder knob at the bottom. The two contacts are separated by an insulator **Effects of an electric current** • a current can heat a resistance wire (such as a bulb filament) - an electrical current transfers energy to the particles in a bulb filament, producing light that the filament emits - circuits can overheat if a short circuit occurs: **o fuses** are special wires which break the circuit when they overheat and melt. These are safety devices that reduce the danger when using electricity **o a short circuit** can occur when an electric current takes the path of lowest resistance, for example when a conductor is connected directly to both terminals of a cell/ battery • a current causes a magnetic field (such as in electromagnets) - an electric current can be used for making temporary magnets known as electromagnets. Moving charges (current) in a conductor (such as a wire), cause a magnetic field around it • an electric current can cause a chemical reaction in a solution, this process is called electrolysis - water can be broken down by electrolysis to produce oxygen and hydrogen gas - copper(II) chloride solution can be broken down to copper metal and chlorine gas. Copper is deposited on one electrode (cathode) and chlorine gas is formed as bubbles at the other electrode (anode)	• **reading** about how fuses work • **investigating** the heating effect of a current by using a resistance wire (such as a strand of steel-wool/ nichrome wire) - observe, record and write about the effect - predict or interpret information about other applications • **investigating** the magnetic effect of a current in a wire bent into a coil - observe and record its effect on a magnetic compass - predict or interpret information about other applications • **investigating** electrolysis of copper(II) chloride solution - observe and record what happens - predict or interpret information about other applications	• Cells/batteries • Circuit boards • Torch bulbs • Switches • Resistors (steel wool or nichrome wire) • Copper wires • Steel wires • Copper(II)chloride • Magnetic compasses • other (available) input and output devices

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
2 weeks	**Series and parallel circuits**	**Series circuits** • a series circuit provides only one pathway for the current passing through it. The current is the same everywhere in the circuit but every time a resistor is added in series, the overall current in the circuit decreases **Parallel circuits** • a parallel circuit provides two or more pathways for the current passing through it, but the overall current increases when more resistors are added in parallel **Other output devices** • other complex circuits are used for output devices such as beepers, buzzers, LEDs (Light Emitting Diodes) or motors	*[**Note:** Use simple circuit boards, and draw circuit diagrams showing all components used, for the following investigations (the effects of resistance are treated qualitatively by observing the brightness of a bulb in the circuit)]* • **investigating** a series circuit by observing the effects of connecting more resistors (such as bulbs) into the circuit (observe the brightness of the light bulbs as more bulbs are added) - insert more bulbs in series into the circuit • **investigating** a parallel circuit by observing the effects of connecting more resistors (bulbs) in parallel into the circuit (observe the brightness of the light bulbs as more bulbs are added) - insert more bulbs in parallel into the circuit • **comparing** the effects of resistors in series and in parallel by recording observations in a table • **investigating** how different metals conduct electricity differently (all conductors have some resistance) in a series circuit. Observe the effects on the brightness of the light bulbs - insert different conductors (wires such as copper, nichrome) into a series circuit • **researching** and writing about notable events in the history of electricity in South Africa and elsewhere • **finding out** about careers in electrical engineering, (such as electricians) electronics, electricity supply maintenance *[not for examination purposes]*	• Cells/batteries • Circuit boards • Torch bulbs • Switches • Resistors (various conducting wires, steel wool or nichrome wires) • Copper wires • Steel wires
3 weeks	**Visible light**	**Radiation of light** • light is emitted from luminous objects such as the Sun and light bulbs, and is transferred by radiation • light travels in straight lines • light travels through empty space at a speed of 300 000 kilometres per second (the distance from the Sun to Earth is 150 million kilometres) *(refer to Grade 7 Energy and Change)*	• **drawing** a ray diagram to explain the image formed in the tissue paper at the back of the pinhole camera *[Teacher can demonstrate using a pinhole camera]*	• Video clips from the internet about the electro-magnetic spectrum • Pinhole camera (if available) • Cardboard box (shoe box) • Tissue paper • Glue

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Visible light *[continued...]*	**Spectrum of visible light** • white light consists of a spectrum (range) of different frequencies and wavelengths - violet, indigo, blue, green, yellow, orange, red. All these colours make up the spectrum of visible light ***[Note**: NO further detail on wavelengths and frequencies is required at this level]* • a rainbow is seen when light falls on water droplets in the air and is refracted and dispersed into the different colours (violet, indigo, blue, green, yellow, orange, red) seen in the rainbow • the light at the violet, indigo, blue range of the spectrum has the highest frequency (shortest wavelength) and orange and red light has the lowest frequency (longest wavelength)	• **observing and recording** the sequence of colours in the visible spectrum when light is shone through a triangular prism	• Pin • Tinfoil (to make a pinhole camera) • Light source • Cardboard with narrow slit • Triangular prism
		Opaque and transparent substances • light cannot pass through opaque surfaces (such as metal, clay, bricks, wall paint, cardboard), therefore it is either absorbed or reflected • opaque substances cast shadows on the side facing away from the light source • light passes through transparent substances (such as glass, clear plastic, cellophane, clean water), therefore some of the light is absorbed, some is reflected, but most passes through	• **drawing** diagrams to show how shadows are cast by opaque objects. • **predicting** effects of moving the object (such as a cardboard shape) closer or further away from the light source	• Light source • Cut-out cardboard shapes
		Absorption of light • light can be absorbed by surfaces of some materials • light is absorbed differently by different materials • a material has colour because it absorbs some of the colours in the spectrum (some of the frequencies) and reflects other colours • the frequencies that are absorbed do not reach the eye - a red object (such as a wall painted red) reflects the frequencies we see as red and absorbs other frequencies/ colours such as violet, indigo, blue, green - a black object (such as a black pot) absorbs all of the frequencies/colours and therefore looks black *[links to absorption of heat by matt black surfaces: Grade 7]* - a white object (such as white paper) reflects all of the frequencies/colours and therefore looks white *[links to reflection of heat by shiny silver or white surface Grade 7]*		• Textbooks and reference materials • Video clips from the internet

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Visible light *[continued...]*	**Reflection of light** • light is reflected off most surfaces, including mirrors • light can change its direction when it is reflected • in reflection, the angle of incidence and the angle of reflection are equal • the angles of incidence and reflection are measured from the normal which is a line perpendicular to the surface *[actual measurement of angles not included here]* • on smooth surfaces, all light is reflected in the same direction • on rough surfaces, reflected light is scattered	• **drawing** a ray diagram to show the change in direction of light rays at a smooth reflector (such as a mirror) • **drawing** a ray diagram to show the changes in direction of light rays reflected off a rough surface (such as crumpled aluminium foil). Reflected light is scattered in different directions	• Mirror • Light source • Aluminium foil
		Seeing light • the frequencies/colours that are reflected enter the eye • specialised receptor cells in the eye's retina are stimulated by specific frequencies (colours) • in the eye, light energy is converted to electrical nerve impulses • impulses travel to the brain and the brain interprets them as our perceptions of light • the frequencies/colours of light that are absorbed by the surface of an object do not reach the eye	• **explaining** why - a blue car looks blue - a sunflower is yellow - leaves are green *[Similar examples may be used]*	
		Refraction of light • light can be refracted by transparent substances • light can change its direction when it is refracted • light entering a transparent medium (such as glass, water, perspex) at an angle, changes direction towards the normal in that medium • light travelling out of the medium (back into the air) changes direction away from the normal • a triangular prism is able to refract and disperse white light into the colours observed in a rainbow • a lens is able to refract and focus light	• **demonstrating** the change in the direction of a light ray (beam) through a parallel sided prism • **inserting** a pencil/ruler in a glass of clean water and observing the apparent change in position of the pencil/ruler below the surface of the water, as a result of refraction • **drawing** a ray diagram of a triangular prism and a magnifying glass (lens) to show dispersing and focusing of light • **discussing** about careers in optics, physics, optical transmission of information (fibre optics) *[not for assessment purposes]*	• Reference materials • Video clips from the Internet • Parallel sided prism • Light source • Cardboard with a narrow slit or glass • Pencil or ruler • Clear container with water

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
Assessment guidelines	This content and the associated concepts must be integrated with the aims and skills for Natural Sciences *(refer to **Section 2**)*. • Learners should read, write, draw and do practical tasks regularly • Evidence of learner's work, including assessments, should be kept in the learner's notebook School-based assessment (including practical tasks and class tests), checking for correctness, and providing constructive feedback should be done regularly. Allow for a maximum of 6 hours to be used for assessment throughout the term. For more detailed guidelines on assessment, *refer to **Section 4.***		**Check the Learner's knowledge and that they can**: • name the components in an electrical circuit, explain how they are connected to form a complete conducting pathway and interpret the symbols used in a circuit diagram correctly • show and describe how to: - make a simple fuse - make a simple electromagnet - carry out electrolysis • describe the role of a resistor in a circuit • demonstrate and explain the effects on the brightness of the light bulbs when connected in a series circuit compared to when connected in a parallel circuit • describe the visible spectrum of light formed when light is shone through a triangular prism • explain the colour of an object in terms of absorption and reflection of light • demonstrate and explain the refraction of light	

GRADE 8 TERM 4				
STRAND: PLANET EARTH AND BEYOND				
TIME	**TOPIC**	**CONTENT & CONCEPTS**	**SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS**	**EQUIPMENT AND RESOURCES**
3 weeks	**The Solar System**	**The Sun** • the Sun is like all other stars – it produces large amounts of heat and light continuously • the energy in our Sun comes from powerful nuclear reactions during which hydrogen gas changes into helium gas **Objects around the Sun** • a variety of objects orbit the Sun - eight planets and their moons, rocky asteroids, outer dwarf planets and many distant icy and dusty objects in the Kuiper Belt and Oort Cloud, at the edge of the Solar System • all the planets and other objects in the Solar System have their own special features including size, distance from the Sun, number of moons known, composition, surface temperature, time it takes for one orbit around the Sun • comets from the Oort Cloud come close to the Sun from time to time • the Solar System looks like a flat disc or plate. The Sun spins (rotates) at the centre and the planets and all other objects orbit around it in the same direction • gravity is the force that keeps all these objects in their stable, predictable orbits around the Sun **Earth's position in the Solar System** • the Earth is the third planet from the Sun • the Earth is the only planet that is known to support life • the conditions that support life on Earth include: - temperature: Earth's distance from the Sun provides the ideal temperature range - water is a liquid, gas or solid in Earth's temperature range - sunlight provides the energy in the food chain - oxygen: early life forms and algae produced enough oxygen for the evolution of more sophisticated life forms	• **constructing** a model of the Solar System showing relative distances of the planets from the Earth and relative sizes of planets • **interpreting** a table of facts about the Solar System • **comparing and writing** about the conditions on other planets in our Solar System including their special features **OR** • **presenting** a fact sheet about any object found in our Solar System • **writing** about why the conditions on Earth are ideal for life	• Textbooks and reference materials • Video clips from the internet showing: - Surface of the Sun - Movement of the planets around the Sun - Meteors, asteroids, comets • Table of facts about the Solar System

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
3 weeks	**Beyond the Solar System**	**The Milky Way Galaxy** • our Solar System is in the Milky Way Galaxy • a galaxy is a collection of stars held together by their mutual gravity • our Sun is only one of billions of stars in the Milky Way Galaxy • the Milky Way Galaxy is in the shape of a spiral with many arms • our Sun is located towards the edge of the Milky Way Galaxy in one of the spiral arms • from the Earth, looking towards the centre of the Milky Way Galaxy, we see a hazy path of light across the sky • ancient Greeks described it as spilled milk **Our nearest star** • the Sun is the nearest star to Earth • the star called *Alpha Centauri* is the nearest easily visible star to the Sun (it is the brighter of the two Pointers of the Southern Cross constellation) • *Alpha Centauri* is 4,2 light years away from our Solar System **Light years, light hours and light minutes** • people use light years to measure distances to stars and other objects beyond the Solar System • a light year is the distance that light travels in one year • one light year is equal to about 10 trillion kilometres (km) • *Alpha Centauri* is 42 trillion km away • a light hour is the distance that light travels in one hour • our Solar System has a diameter of about 13 light hours • a light minute is the distance that light travels in one minute • the Earth is about 8 light minutes away from the Sun **Beyond the Milky Way Galaxy** • our Milky Way Galaxy is only one of billions of galaxies scattered across the Universe • the size of the observable Universe is estimated to be about 28 billion light years • galaxies have various shapes and sizes	• **demonstrating** the shape of the Milky Way Galaxy with a spiral shape • **drawing** spiral arms to represent the Milky Way Galaxy and placing our Solar System in the outer edges of the spiral to show our its location in the galaxy	• Video clips from the internet showing: - Images of the Milky Way Galaxy - Images of other galaxies

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
2 weeks	**Looking into space**	**Early viewing of space** • people can see planets and stars in the night sky • stars can be arranged into visible constellations • different cultures have identified and named certain constellations • some constellations have stories linked to them **Telescopes** • people can see more details in the sky when they use a telescope • a telescope forms an image of the object and magnifies it (makes it look bigger) • there are different types of telescopes including: - optical telescopes receive light and focus it by refraction (using lenses) or reflection (using mirrors) such as SALT (Southern Africa Large Telescope), and the Hubble Space telescope - radio telescopes receive radio waves and focus them by reflection (typically using a metal receiving dish) such as the SKA (Square Kilometre Array) • good conditions for looking into space include cloudless skies with limited light and air pollution • South Africa has many locations that meet these requirements	• **using** star maps of the Southern Sky to identify a few easily recognisable constellations such as the Southern Cross, Orion and also the planets **OR** • **observing**, **recording and comparing** the appearance of the Southern Cross constellation by viewing it at least three times during the months of September and October • **drawing** with labels to explain how a telescope works *[choose any type of telescope]* • **presenting** an information poster on a telescope, explaining how it is used and noting the most important information it has captured • **discussing** the many opportunities in South Africa for careers in astronomy *[not for assessment purposes]*	• Video clips and images from the internet such as: - Constellations - SALT telescope - Hubble telescope - SKA telescope • Star maps from the internet
Assessment guidelines	This content and the associated concepts must be integrated with the aims and skills for Natural Sciences *(refer to **Section 2**)*. • Learners should read, write, draw and do practical tasks regularly • Evidence of learner's work, including assessments, should be kept in the learner's notebook School-based assessment (including practical tasks and class tests), checking for correctness, and providing constructive feedback should be done regularly. As this is an exam term, the final two weeks may be required for revision. For more detailed guidelines on assessment, *refer to **Section 4.***		**Check the learner's knowledge and that they can**: • interpret information about the special features of the planets and objects in our Solar System and describe them • explain why life can exist on planet Earth • describe the main features of a star, the Milky Way Galaxy, and beyond the Milky Way Galaxy • explain the concept of light minutes, light hours and light years • identify and describe the most important telescopes in South Africa • identify some of the constellations of the Southern Sky	

GRADE 9 TERM 1				
STRAND: LIFE AND LIVING				
TIME	**TOPIC**	**CONTENT & CONCEPTS**	**SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS**	**EQUIPMENT AND RESOURCES**
2 weeks	**Cells as the basic units of life**	**Cell structure** • the cell is the basic structural and functional unit of all living organisms. Cells can be seen under a microscope (they are microscopic) • plant and animal cells have a cell membrane, cytoplasm, nucleus, and organelles such as mitochondria, vacuoles and chloroplasts - the *cell membrane* encloses the contents of the cell. It allows specific substances to pass into and out of the cell - the *cytoplasm* is the jelly-like medium in which many chemical reactions take place - the *nucleus* contains DNA o the nucleus is enclosed by a *nuclear membrane* (in plants and animals) o DNA contains inherited characteristics, such as whether eyes are blue or brown o DNA is unique to each person; this *variation* accounts for differences within species - *Mitochondria* are responsible for respiration to release energy from food	• **making** a 3-dimensional (3D) model of a cell • **drawing, labelling and describing** the structure of plant and animal cells	• Textbooks and other reference material • 3 dimensional (3D) model of a cell, and/or pictures
		Differences between plant and animal cells • plant cells differ from animal cells - plant and animal cells are enclosed by a cell membrane, and plant cells also have rigid cellulose *cell walls* to provide support for the plant - plant cells also contain organelles such as large vacuoles and chloroplasts. *Chloroplasts* contain chlorophyll to absorb light energy for photosynthesis *(refer to Grade 8 Life & Living).* Vacuoles in plant cells have several functions including support and storage (Vacuoles in animal cells are small and temporary or absent)	• **identifying and explaining** the main differences between plant and animal cells	

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Cells as the basic units of life *[continued...]*	**Cells in tissues, organs and systems** • cells come in many different shapes and sizes • cells are adapted to perform specific functions, such as muscle cells which are specialised to contract and enable movement • microscopic organisms such as bacteria, consist of a single cell. Macroscopic organisms such as humans, consist of large numbers of cells • a group of cells performing a specific function form a tissue, a group of tissues make up an organ, and organs working together in groups form systems, systems make up an organism • stem cells are cells that have the ability to divide and develop into many different cell types *[No detail required]*	• **researching and writing** about the history of the discovery of the light and electron microscopes • **tabulating** functions of the different parts of a basic light microscope • **preparing and examining** slides of plant and animal cells such as onion cells, cheek cells. Draw and label a few cells from each observation **AND/OR** • **examining** micrographs of plant and animal cells. Draw and label cells from at least two different tissue types • **researching, discussing and writing** about stem cell research and ethical issues involved	• micrographs of plant and animal cells
2 weeks	**Systems in the human body**	*[**Note:** The intention of this topic is to provide learners with an overview of the structure and functions of organs and systems in the human body]* **Body systems** • the human body consists of several integrated systems working together including the following • **digestive system:** breaks down food into dissolved nutrients that can be absorbed into the blood stream and transported to cells throughout the body - the main processes include ingestion, digestion absorption and egestion - the main components include the mouth, oesophagus, stomach, intestines, liver - health issues include ulcers, *anorexia nervosa*, diarrhoea, liver cirrhosis • **circulatory system:** brings nutrients and oxygen to cells and removes waste products - the main processes include circulating blood between heart and lungs, and circulating blood between the heart and the rest of the body - the main components include the heart, blood vessels (arteries, veins, capillaries), blood - health issues include high blood pressure, heart attacks, strokes	• **drawing** a large outline of the human body. Draw and label each system *[as it is dealt with],* onto the outline *[photocopy one outline of the human body for each learner, as well as a set of systems and organs which they can cut out and stick onto the outline]* • **researching and writing** about the health issues related to each system	• Models or charts of torso, heart, kidney, digestive system, lungs

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Systems in the human body *[continued...]*	**Body systems** *[continued...]* • **respiratory system:** is responsible for supplying oxygen to the body and for removing carbon dioxide - the main processes include breathing (inhalation and exhalation), gaseous exchange (diffusion) and respiration - the main components include the nose and mouth, trachea and other air passageways, lungs, blood - health issues include asthma, lung cancer, bronchitis, asbestosis • **musculoskeletal system:** muscles produce body movement. The skeleton protects the body, provides support and enables movement - the main processes include contraction and relaxation of muscles, locomotion and movement - the main components include the muscles, bones, cartilage, tendons, ligaments - health issues include rickets, arthritis, osteoporosis • **excretory system:** removes waste from the blood and regulates the body's fluids - the main processes include filtration, absorption, diffusion, excretion - the main components include the kidneys, bladder, ureters - health issues include kidney failure, bladder infection, kidney stones • **nervous system:** receives and helps the body respond to stimuli - the main processes include hearing, seeing, feeling, tasting, smelling, sending and receiving impulses, regulating temperature - the main components include the brain, spinal cord, nerves, ears, nose, eyes, skin, tongue - health issues include deafness, blindness, short sightedness, effects of drugs and alcohol on the brain		

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Systems in the human body *[continued…]*	**Body systems** *[continued...]* • **reproductive system:** produces sex cells for the purpose of continuation of the species - the main processes include growth, cell division, maturation, copulation, ejaculation, ovulation, menstruation, fertilisation, implantation - the main components include testes, ovaries, uterus - health issues include infertility, foetal alcohol syndrome, STDs	**producing** a poster advocating healthy life style choices	
2 weeks	**Human Reproduction**	**Purpose and puberty** • the main purpose of reproduction is for the gametes (male and female sex cells) to combine for the continuation of the species • puberty is the stage in the human life cycle when sexual organs mature for reproduction. This process is initiated when the pituitary gland releases hormones into the blood stream, triggering the testes and ovaries to release sex hormones (testosterone and oestrogen) • testosterone (from the testes) and oestrogen (from the ovaries) cause secondary sexual characteristics such as menstruation, breast development, pubic hair, facial hair, deepening of the male voice **Reproductive organs** • the male reproductive organs include the penis, sperm duct (*vas deferens*), testes (produces sperm cells), scrotum, urethra • the female reproductive organs include the vagina, uterus, ovaries (contain egg cells/ ova), oviducts (Fallopian tubes)	• **labelling** diagrams and **explaining** processes involved in reproduction • **drawing** flow charts to show the sequence of the stages in reproduction • **researching and writing** about the effects of alcohol, smoking and drug abuse on the foetus *[Relate this to the role of the placenta]* • **debating and discussing** issues such as abortion, infertility, surrogacy, contraception, population control	▪ Models or charts of the reproductive system

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Human Reproduction *[continued…]*	**Stages of reproduction** • once a month, one of the ovaries releases a ripe egg in a process called *ovulation* • in preparation for a fertilised egg, the uterus develops a thick layer of blood • if fertilisation does not take place, *menstruation* occurs • menstruation is the breakdown of the thick layer of blood in the uterus, which is released through the vagina • the menstrual cycle is usually a 28 day cycle • during *copulation*, the erect penis is inserted into the vagina and semen is released (*ejaculation*) • *fertilisation* is the fusion of the sperm and egg, producing a zygote • if fertilisation takes place, the fertilised egg is implanted in the blood layer in the uterus, and pregnancy results • the developing embryo/foetus is attached to the uterus wall by the placenta which plays a vital role in feeding and removing waste from the foetus • the stage of pregnancy in humans (gestation) is about 40 weeks • pregnancy can be prevented by using contraceptives such as condoms to prevent the sperm reaching the egg • condoms also prevent the transmission of HIV/AIDS and other STDs (sexually transmitted diseases), if used effectively		

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
1 ½ weeks	**Circulatory and respiratory systems**	**Breathing, gaseous exchange, circulation and respiration** • oxygen is *inhaled* in a process called breathing • in the lungs gases are exchanged (*gaseous exchange*) between the alveoli and the surrounding capillaries by the process of *diffusion* • oxygenated blood is transported (*circulation*) from the lungs to the left side of the heart where it is pumped under high pressure to the body through the arteries *[arteries transport oxygenated blood, except for the pulmonary arteries]* • arteries subdivide to form capillaries which are in close contact with the body cells. Here, *gaseous exchange* occurs and oxygen moves into the cells by the process of *diffusion* • in the mitochondria of the cells, oxygen is combined with food in the process of *respiration* and energy is released for other body processes • carbon dioxide (by-product of *respiration*), diffuses from the cells into the capillaries for excretion, and is transported (*circulation*) in the blood to the right side of the heart by veins *[veins transport deoxygenated blood, except for the pulmonary veins]* • the heart pumps the deoxygenated blood (contains carbon dioxide), to the lungs where it is, where it diffuses into the air that is *exhaled* out of the body	• **measuring and comparing** heart rates before and after exercise - collect information/data on at least 10 learners - identify the variables - draw a bar graph of the results - make deductions about the fitness of the learners based on heart rate - writing about the benefits of exercise for the cardio vascular system • **drawing** up a table of differences between arteries, veins and capillaries • **labelling** diagrams of the respiratory system • **dissecting** a pig or sheep heart and lungs *[obtained from butchery]* to examine the structure • **drawing** flow charts to show the sequence of the stages from inhaling oxygen, to respiration, to exhaling carbon dioxide • **researching and writing** about one of the causes of health issues (such as smoking, drinking alcohol, high cholesterol levels) associated with the circulatory and respiratory systems	• Sheep/pig • heart and lungs • Stop watch/cell phone (for timing)
1 ½ weeks	**Digestive system**	**Healthy diet** • a healthy diet (eating plan) requires different components including proteins, carbohydrates, fats and oils, vitamins and minerals, fibre and water • disorders of the digestive system can be related to inappropriate eating plans	• **conducting** an investigation to test for the presence of starch and grease *(fats and oils)* in food. Write an experimental report using the headings; aim, hypothesis, method, results, conclusion and discussion *[Add a few drops of iodine solution to test for starch, crush food, mix with alcohol / ethanol, stain a white paper with mixture]*	• Pictures of eating disorders • Video clips • Samples of food • Iodine solution • White paper • Ethanol or pure alcohol

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Digestive system *[continued…]*	**The alimentary canal and digestion** • the alimentary canal is composed of the mouth, oesophagus, stomach, small intestine, large intestine, rectum and anus • digestion is the breakdown of food into a usable dissolved form There are two types of digestion: - mechanical digestion involves the physical breaking, crushing and mashing of food - chemical digestion involves the mixing food with digestive enzymes and hydrochloric acid *[no detail of the enzymes required]* • the structure of each part of the alimentary canal is adapted to its function *[no detail required]*	• **conducting** a starch test and grease test on a variety of foods such as potatoes, raw pasta, cheese • **discussing** a variety of unhealthy dietary components such as additives, and the harmful effects of some diets such as eating too much fast food and diets developed for weight loss • **comparing** balanced diets from different cultures such as kosher / halaal and non-kosher / non-halaal food	
Assessment guidelines	This content and the associated concepts must be integrated with the aims and skills for Natural Sciences *(refer to **Section 2**)*. • Learners should read, write, draw and do practical tasks regularly • Evidence of learner's work, including assessments, should be kept in the learner's notebook School-based assessment (including practical tasks and class tests), checking for correctness, and providing constructive feedback should be done regularly. Allow for a maximum of 6 hours to be used for assessment throughout the term. For more detailed guidelines on assessment, *refer to **Section 4***		**Check the learner's knowledge and that they can**: • identify, describe and give the function of the basic components of plant and animal cells • draw and label a generalised plant and animal cell • explain the relationship between cells, tissues, organs and systems • list the systems *[dealt with]*, and give the purpose and main components of each • describe and give the function of the male and female reproductive organs • explain the main processes in reproduction, such as menstruation, fertilization • explain the impact of factors on the foetus during pregnancy, such as smoking, alcohol • describe breathing, gaseous exchange and respiration • label the reproductive, respiratory and digestive systems	

GRADE 9 TERM 2				
STRAND: MATTER AND MATERIALS				
TIME	**TOPIC**	**CONTENT & CONCEPTS**	**SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS**	**EQUIPMENT AND RESOURCES**
1 week	**Compounds**	**Briefly review and revise** concepts dealt with in Grade 8, focusing on compounds **The Periodic Table** *[**Note:** use the Periodic Table of Elements as a reference tool in the topics that follow]* • the elements can be classified into metals, non-metals and semi metals • the elements found in groups (vertical columns) have similar chemical properties		• Textbooks and reference materials
		• each element on the Periodic Table (in its own block) has an atomic number (smaller number), mass number (larger number), name and symbol • a formula/e is ratio of the symbols of the elements and number of atoms for each symbol in a compound	• **memorising** the name and the symbol of each of the first 20 elements, on the Periodic Table, as well as iron (Fe), copper (Cu), zinc (Zn) *[learners need not memorise the atomic number of each element]*	• Periodic Table of Elements
		Names of compounds • many compounds are named according to their elements, such as sodium chloride (table salt) which is made of the elements sodium and chlorine. But others have common names such as water and ammonia • some compounds have names such as carbon monoxide CO, carbon dioxide CO_2, sulfur trioxide SO_3. In these compounds: - ***mono***xide- tells us that ***one*** oxygen atom has combined with the carbon atom - ***di***oxide- tells us that ***two*** oxygen atoms have combined with the carbon atom - ***tri***oxide- tells us that ***three*** oxygen atoms have combined with the sulfur atom	• **naming, writing** symbols, and **drawing** pictures **or** **making models** (using beads, beans or plasticine or playdough) of several elements and compounds. Including: water (H_2O), oxygen (O_2), carbon monoxide (CO), carbon dioxide (CO_2), copper oxide (CuO), sodium chloride (NaCl), sulfur trioxide (SO_3) *[**Note:** the latest internationally accepted spelling is now sulfur not sulphur]*	• beads/ beans/ plasticine or playdough

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
1 weeks	**Chemical reactions**	**Chemical equations to represent reactions** • chemical reactions can be represented with models • chemical reactions are usually represented with symbols such as in chemical equations: For example: - $C+O_2 \longrightarrow CO_2$ - $2H_2+O_2 \longrightarrow 2H_2O$ • the subscript number indicates the number of atoms of an element found in the formula • the numbers in front of the compounds indicate the ratio in which the molecules react. For example two molecules of hydrogen react with one molecule of oxygen to form water, therefore the ratio is 2:1 (H:O) • no atoms are lost or gained in the reaction, they are simply rearranged **Balanced equations** • chemical equations must be written as balanced chemical equations. The total number and type of atoms of the reactants is the same as in the products. The above equations are therefore balanced in the following way: - $4Fe + 3O_2 \longrightarrow 2Fe_2O_3$ (brown rusty coating) - $2Mg+ O_2 \longrightarrow 2MgO$ (white powder) • another example is copper reacting with oxygen to form copper oxide. This is a very slow reaction - word equation: copper + oxygen ⟶ copper oxide chemical equation: $2Cu + O_2 \longrightarrow 2CuO$ *[Learners are not required to write the formulae/symbols for other word equations]*	• **naming, writing** symbols, and **drawing** pictures or **making models** (using beads, beans or plasticine or playdough) of the chemical reactions: - $C+O_2 \longrightarrow CO_2$ - $2H_2+O_2 \longrightarrow 2H_2O$ *[make models of the reactants and rearrange the atoms to show how the products are formed]*	• Plastic beads/ beans/ plasticine or playdough

Note: *Grade 9 learners must write the names and the formulae (chemical symbols) of ALL the substances for every reaction that follows.*

They must also identify the relevant elements, mentioned in the reactions, on the Periodic Table of Elements

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
1 ½ weeks	**Reactions of metals with oxygen**	**The general reaction of metals with oxygen** • some metals react with oxygen during burning (combustion) • when a metal reacts with oxygen, a metal oxide is formed as a product. The general equation for this type of reaction is always: metal + oxygen ⟶ metal oxide **Reaction of iron with oxygen** • when the metal iron is burnt in air (which contains oxygen), the reaction forms iron oxide as a product - word equation: iron + oxygen ⟶ iron oxide - chemical equation: $Fe + O_2 \longrightarrow Fe_2O_3$ [unbalanced] **Reaction of magnesium with oxygen** • when the metal magnesium is burnt in air (which contains oxygen), the reaction forms magnesium oxide as a product - word equation: magnesium + oxygen ⟶ magnesium oxide - chemical equation: $Mg + O_2 \longrightarrow MgO$ [unbalanced]	• **burning** a small amount of steel wool *[use a pair of tongs to hold the steel wool in the flame of a Bunsen/ spirit burner until it ignites]* *[**Safety note: Teacher demonstration only**. Steel wool gets very hot when it burns, and can produce sparks. Be careful not to start a fire or burn yourself]* • **burning** a small amount of magnesium ribbon *[use a pair of tongs to hold the magnesium ribbon in the flame of a Bunsen/spirit burner until it ignites].* *[**Special note:** Keep the white oxide produced from this reaction to use later in "reactions of acids with metal oxides"]* *[**Safety note: Teacher demonstration only**. Magnesium ribbon produces a very bright light which can permanently damage eyes if looked at directly. Ask learners to look to the side and just be aware of the bright light rather than looking at it directly. Be careful not to start a fire or burn yourself]*	• Heat source (such as Bunsen burner or spirit lamp) • matches • Safety goggles • Steel wool • Tongs/ pliers • Heat source (such as Bunsen burner or spirit lamp) • matches • Safety goggles • magnesium ribbon • Tongs/ pliers

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Reactions of metals with oxygen *[continued…]*	**Formation of rust** • rusting is a slow chemical reaction of iron metal, with oxygen and moisture (water) to form a complex compound part of which is iron oxide. • rust (a form of corrosion) only occurs at the surface of the iron exposed to the air • steel (which consists mostly of iron) is an essential material in modern construction. Equipment and structures can rust, and weaken **Ways to prevent rusting** • iron and steel can be painted to keep away moisture and oxygen • iron and steel can be coated with a thin layer of chromium or zinc (metals which do not rust) This is done by an electroplating technique which is a form of electrolysis		• Pictures of rusty objects
1 week	**Reactions of non-metals with oxygen**	**The general reaction of non-metals with oxygen** • non-metals react with oxygen to form non-metal oxides • when any non-metal is burnt in excess oxygen, the general equation is always: non-metal + oxygen $\longrightarrow$ non-metal oxide **Reaction of carbon with oxygen** • when the non-metal carbon is burnt in oxygen, carbon dioxide is produced - word equation: carbon + oxygen $\longrightarrow$ carbon dioxide - chemical equation: $C + O_2 \longrightarrow CO_2$ (this equation is already balanced) **Reaction of sulfur with oxygen** • another example is sulfur reacting with oxygen to form sulfur dioxide - word equation: sulfur + oxygen $\longrightarrow$ sulfur dioxide - chemical equation: $S + O_2 \longrightarrow SO_2$ (this equation is already balanced)	• **naming, writing** symbols, and **drawing** pictures or **making models** (using beads, beans or plasticine or playdough) of the chemical reaction: - $S + O_2 \longrightarrow SO_2$ *[Make models of the reactants and rearrange the atoms to show how the products are formed]* *[**Note:** It is not required to demonstrate the above reaction, as the product sulfur dioxide is dangerous for asthmatics. This reaction cannot be done safely in most classrooms]*	- Plastic beads/ beans/ plasticine or playdough

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
1 week	**Acids & bases, and pH value**	**The concept of pH value** • pH is a measure of how acidic or basic a substance is. The pH scale ranges from 1 to 14 • acids have a pH in the range of 1 to 7. Strong acids have very low pH values • bases have a pH in the range of 7 to 14. Strong bases have very high pH values • a neutral substance has a pH of 7 • we use chemical indicators (such as universal indicator, litmus paper, red cabbage water, red onion water, turmeric water, bromothymol blue, phenolphthalein) to tell us whether a substance is an acid, base or neutral • universal indicator has the ability to indicate the full range of pH values on the pH scale by colour changes - acids change the colour of universal indicator towards the yellow, orange and red colours - bases change the colour of universal indicator towards the blue and purple colours - neutral substances (pH 7), change the colour of universal indicator to green	• **investigating** a selection of household substances (such as water, tea and rooibos, coffee, milk, fruit juices, vinegar, tartaric acid, washing powder, bicarbonate of soda, salt water) to test whether they are acids, bases or neutrals using universal indicator and at least one other indicator (such as red cabbage water, red onion water, turmeric water, bromothymol blue, phenolphthalein). Record results (colour change) on a table and draw conclusions (acid, base or neutral) • **sequencing** the above substances according to the colour change of the universal indicator, from the most acidic (darkest red) to the most basic (purple) *[**Note:** see Appendix 1 (at the end of this term) for colour changes of these indicators]*	• Universal indicator • Red cabbage/ red onion/ turmeric/ bromothymol blue or phenolphthalein • Test tubes • Test tube racks • Glass containers • Liquids such as: tea, rooibos, coffee, milk, fruit juices, fizzy drinks • Household substances such as: vinegar, tartaric acid, lemon, soap, bicarbonate of soda, liquid soap
½ week	**Reactions of acids with bases: Part I**	**Neutralisation and pH** • acids and bases react together, we call this a neutralisation reaction • a base reacts with an acid, to make it less acidic / neutral • an acid reacts with a base, to make it less basic / neutral • acids commonly used in the laboratory include sulphuric acid (H_2SO_4) and hydrochloric acid (HCl) • after reacting an acid and a base together, the resultant pH will vary based on the strength of the acid and base reactants • non-metal oxides tend to be acidic (low pH) • bases (high pH) include metal oxides, metal hydroxides, metal carbonates	• **investigating** neutralisation by reacting vinegar (acid) with bicarbonate of soda (base) *[Use universal indicator to find the approximate point at which the acid completely neutralises the base (**Hint**: universal indicator must turn green)]*	• Beakers/ glass jars • Test tubes • Vinegar • Bicarbonate of soda • Water • Universal indicator

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
1 week	**Reactions of acids with bases: Part II**	**The general reaction of an acid with a metal oxide (base)** • when metals react with *oxygen*, they tend to form oxides which are bases *(see reactions of metals with oxygen)* • when any acid reacts with a metal oxide, the products formed are *a salt* and *water*. The type of salt formed will depend on the specific acid and metal oxide used in that reaction • the general equation is always: acid + metal oxide ⟶ salt + water • *Example*: - word equation: hydrochloric acid + magnesium oxide ⟶ magnesium chloride + water - balanced chemical equation: $2HCl + MgO \longrightarrow MgCl_2 + H_2O$ **Applications** • burning wood and fossil fuels releases carbon dioxide and sulfur dioxide into the atmosphere. These combine with water in the atmosphere to produce acid rain • limestone ($CaCO_3$) is used in agriculture to make soil less acidic **The general reaction of an acid with a metal hydroxide (base)** • when metals react with *water*, they tend to form hydroxides which are bases • when any acid reacts with a metal hydroxide, the products formed are *a salt* and *water*. The type of salt formed will depend on the specific acid and metal oxide used in that reaction • the general equation is always: acid + metal hydroxide ⟶ salt + water • *Example*: - word equation: hydrochloric acid + sodium hydroxide ⟶ sodium chloride + water - balanced chemical equation: $HCl + NaOH \longrightarrow NaCl + H_2O$ *[**Note:** sodium chloride (NaCl) is table salt]*	• **investigating** whether the magnesium oxide (MgO) *[kept product from burning magnesium]* is an acid or a base when dissolved in water. Test the pH using universal indicator. Record the pH, and draw conclusions • **reading** about the causes and consequences of acid rain and including possible ways to reduce acid rain *[**Safety note:** For the following activities - LEARNERS SHOULD NOT TRY TO DILUTE HYDROCHLORIC ACID THEMSELVES as acids react strongly with water. An acid must be slowly added to water and not water to an acid to dilute it.]* • **investigating** neutralisation of metal hydroxides by reacting dilute sodium hydroxide (NaOH) with dilute hydrochloric acid (HCl) *[Use universal indicator to find the approximate point at which the acid completely neutralises the base. (**Hint:** universal indicator must turn green) Use a dropper to add the acid as the solution begins to turn the universal indicator yellow to red]* • **recovering** the table salt (sodium chloride) from the above neutralisation by crystallising it (evaporating the solvent) *[**Note:** only do this once you have confirmed that the sodium hydroxide has been completely neutralised (universal indicator turns green)]*	• Magnesium oxide powder • Water • Universal indicator • Test tubes • Test tube racks • Glass containers • Pictures illustrating the effects of acid rain • Dilute sodium hydroxide • Dilute hydrochloric acid • Water • Universal indicator • Beakers/ glass jars • Test tubes • Universal indicator • Heat source (such as Bunsen or spirit burner) • Evaporating tins • Dropper

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
½ week	**Reactions of acids with bases: Part III**	**The general reaction of an acid with a metal carbonate (base)** • metal carbonates are bases • when any acid reacts with a metal carbonate, the products formed are *a salt*, *carbon dioxide* and *water*. The type of salt formed will depend on the specific acid and metal carbonate used in that reaction • the general equation is always: acid + metal carbonate ⟶ salt + carbon dioxide + water • *Example*: - word equation: hydrochloric acid + calcium carbonate ⟶ calcium chloride + carbon dioxide + water - balanced chemical equation: $2HCl + CaCO_3 \longrightarrow CaCl_2 + CO_2 + H_2O$	• **investigating** neutralisation of metal carbonates by reacting chalk dust (calcium carbonate) with dilute hydrochloric acid (HCl) *[Use universal indicator to find the approximate point at which the acid completely neutralises the base (**Hint:** universal indicator must turn green)]*. Collect the carbon dioxide as the reaction proceeds. Test for the presence of carbon dioxide *[**Note:** lime water - $Ca(OH)_2$, is used to test for carbon dioxide (CO_2) gas. When CO_2 is bubbled through clear lime water, it turns white]*	• Chalk dust • Dilute hydrochloric acid • Water • Universal indicator • Beakers/ glass jars • Test tubes • Lime water
½ week	**Reactions of acids with metals**	**The general reaction of an acid with a metal** • when any acid reacts with a metal, the products formed are *a salt* and *hydrogen gas*. The type of salt formed will depend on the specific acid and metal used in that reaction • the general equation is always: acid + metal ⟶ salt + hydrogen gas • *Example*: - word equation: hydrochloric acid + magnesium ⟶ magnesium chloride + hydrogen gas - balanced chemical equation: $2HCl + Mg \longrightarrow MgCl_2 + H_2$	**investigating** reactions of acids with metals by reacting dilute hydrochloric acid (HCl) with magnesium. Test for H_2 gas *[**Note:** a glowing splint is used to test for the presence of hydrogen gas. It produces a popping sound]* • **writing a summary** of the following general chemical reactions, using words. Also give an example of each written as a balanced chemical equation: - metals and non-metals with oxygen - acids with bases (neutralisation) - acids with metal oxides - acids with metal hydroxides - acids with metal carbonates • **reading** about careers in the chemical industry, including agriculture, pharmacy, chemical engineering, mining *[not for assessment purposes]*	• Magnesium • Dilute hydrochloric acid • Water • Beakers/ glass jars • Test tubes • Wooden splint

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
Assessment guidelines	This content and the associated concepts must be integrated with the aims and skills for Natural Sciences *(refer to **Section 2**)*. • Learners should read, write, draw and do practical tasks regularly • Evidence of learner's work, including assessments, should be kept in the learner's notebook School-based assessment (including practical tasks and class tests), checking for correctness, and providing constructive feedback should be done regularly. As this is an exam term, the final two weeks may be required for revision. For more detailed guidelines on assessment, *refer to **Section 4.***		**Check the learner's knowledge and that they can**: • distinguish between pure substances and mixtures • distinguish between elements and compounds • name and make models of simple molecules • for any of the studied reactions: 1) describe it in general terms; 2) describe the changes that occur during the reaction; 3) write a balanced equation • describe the neutralisation of an acid with a base using pH	

Appendix:

Table: Colour changes of selected indicators used in the Senior Phase

INDICATOR	COLOUR IN ACID (pH 1 – 6)	COLOUR IN NEUTRAL (pH 7)	COLOUR IN BASE (pH 8 -14)
Universal indicator	Red, orange, yellow	Green	Blue, violet, purple
Red cabbage water	Red, pink	Violet, purple	Blue, green, yellow
Red onion water	Red	Violet	Green
Tumeric water	Yellow	Yellow	Red
Phenolphthalein	colourless	colourless	Pink, red
Bromothymol blue	Yellow	Green	Blue
Red litmus paper	Red	Red	Blue
Blue litmus paper	Red	Blue	Blue

GRADE 9 TERM 3				
STRAND: ENERGY AND CHANGE				
TIME	**TOPIC**	**CONTENT & CONCEPTS**	**SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS**	**EQUIPMENT AND RESOURCES**
2 weeks	**Forces**	**Types of forces** • a force is a push or pull (or twist) exerted upon an object • force is measured in units called newtons (N)		• Textbooks and reference materials
		• forces that two objects exert on each other always act in pairs • a force can change the shape, direction and speed of an object • all forces acting on objects can be placed into two broad groups: - contact forces - field forces **Contact forces** • a contact force (including friction, tension, compression) results when two bodies are in contact (touch) with each other **Field forces (non-contact forces)** • field forces result from action-at-a-distance between two bodies • common examples of field forces include gravitational, magnetic and electrostatic forces	• **Investigating** physical (mechanical) push and pull forces on objects and materials, such as wooden blocks, sponges, erasers, fabric, balls and balloons. Observe what happens when one person pulls another, when both people pull, when one person pushes, when two people push	• Wooden blocks • Sponges • Rubber (eraser) • Fabric • Balls/balloons
		- **Gravitational force:** gravity is the force of attraction (pull) that objects/bodies have on one another due to their masses. For example the attraction of Sun and planets, Earth and Moon, Earth and objects on the surface (people and things) o objects with greater mass have more gravitational pull on each other o force decreases as distance between the objects increases *(refer to Grade 7 Planet Earth & Beyond)*	• **demonstrating** gravitational force using falling objects: direction is always “downwards” towards the centre of the Earth. The object (small mass) and the Earth (large mass) attract one another	
		o force of gravity is measured in newtons (N) o the weight of an object is the gravitational force exerted on it by the Earth (or the Moon, or another planet). It is also measured in newtons (N) ◊ the mass of the object stays the same no matter where it is determined ◊ however, the weight of an object will change when weighed in different places with different gravitational force such as on Earth compared to the Moon	• **measuring and recording** the weights (in newtons) of different objects using a spring balance and force meter	• Spring balances calibrated in newtons,

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Forces *[continued...]*	**Field forces (non-contact forces)** *[continued...]* • **Magnetic force:** magnets attract magnetic substances including iron, steel, cobalt, nickel - all magnets have two ends/poles (north & south) o opposite poles attract and like poles repel each other (magnetism is the push or pull force) o just like a bar magnet, the Earth has a magnetic field (north and south poles)	• **Investigating** which substances (non-metals and metals) are attracted by a bar magnet, using materials such as paper, wood, plastic, iron, brass, aluminium. Record the observations in table form. • **Investigating** whether a magnetic force can act on a magnetic substance when it is separated from the magnet by different materials such as wood, paper, foil, a hand and steel • **observing** the pattern made by a magnet on iron filings *[sprinkle iron filings on a piece of paper, and place a magnet under the paper]* • **investigating** repulsion and attraction forces of two bar magnets when: - opposite poles are close to each other (pull force) - like poles are close to each other (push force)	• Bar magnets • Iron fillings • Paper • Wood • Plastic • Iron • Brass • Aluminium foil
		• **Electrostatic force:** When certain materials are rubbed together, they can acquire an electrostatic charge as a result of the loss or gain of electrons *[**Note**: only the electrons are transferred, protons cannot move]* - during rubbing, the electrons move from one material causing a positive charge on its surface, and causing a negative charge on the surface of the other material - objects which have like charge (+ and + or - and -) repel (push) each other and those with unlike charge (+ and -) attract (pull) each other *(refer to Gr 8 Energy & Change)* - charged objects in an electrostatic system possess potential energy. The energy comes from the work done during rubbing	• **investigating** how to charge objects by rubbing different materials/objects together using available materials and objects including different fabrics, inflated balloons, plastic combs, perspex, glass, plastic bags and pieces of paper. Observe the electrostatic forces of attraction and repulsion between the objects *[**Note:** This activity does not work well in rainy weather or humid conditions as water droplets in the air allow electric charge to "leak" away from charged objects]*	• Perspex • Plastic ruler/comb • Plastic bags • Silk cloth and other fabrics • Inflated balloons • Glass • Pieces of paper
		- a thunder cloud becomes charged by the rubbing together of air and water particles moving past each other in the atmosphere o a lightning strike occurs when there is a massive discharge (release of charge) between the thunder cloud and the ground. Lightning is a giant spark of electricity o safety precautions should be considered during thunder and lightning storms	• **writing** about safety precautions during thunder and lightning storms	

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
½ week	**Electric cells as energy systems**	**Electric cells** • a cell is a system in which certain chemical reactions can cause the flow of electricity through an external circuit • cells are a source of electricity • a battery is a group of cells that are connected together	• **making** a cell by placing zinc and copper plates, as electrodes - in a solution of laboratory chemicals (such as zinc sulphate and copper sulphate) *[use a cloth soaked in either of the solutions as a salt bridge]* ***OR*** - in an acidic fruit (such as a lemon) *[**Note**: Connect several cells in series until a LED (Light Emitting Diode) is able to light up or connect a sensitive multimeter/voltmeter to the electrodes to show the voltage]*	• Conducting wires • LED bulbs • Zinc and copper plates, zinc sulphate, copper sulphate,
1 week	**Resistance**	**Uses of resistors** • conductors (even good conductors) heat up when current passes through them: some energy is 'lost'/'wasted' as heat. All conductors have some resistance • a resistor is a conducting material selected to control the current or to provide useful energy transfer, such as in bulbs, rheostats, motors, light sensitive diodes, light emitting diodes		
		Factors that affect resistance in a circuit • type of material: different conducting materials have different resistance to an electric current • thickness of the conductor: thinner wires have more resistance than thicker wires • length of the conductor: longer wires have more resistance than shorter wires • temperature of the conductor: generally hotter conductors (metals) have higher resistance than colder conductors	• **investigating** at least one of the factors (type of material, thickness or length of the conductor) that affect resistance of a conductor in a circuit *[make a circuit containing a cell, light bulb and an ammeter in series, then insert the different conductors, one at a time].* Record ammeter readings on a table and draw conclusions *[**Note:** It is not required to do an activity on the effect of temperature at this level]*	• Circuit board • Cells/battery • Different conductors (wires) • Light bulbs or LEDs • Ammeter
2 weeks	**Series and parallel circuits**	**Series circuits** • when ***cells*** are connected together in series, the total voltage is the sum of the voltages (potential differences) of individual cells • ***resistors*** can be connected in series in a circuit • the total voltage across the battery is the same as the sum of the voltages across each of the resistors - a resistor with higher resistance will have higher voltage across it - a resistor with lower resistance will have a lower voltage across it	• **investigating** the effects of connecting more cells in series into the circuit *[observe the brightness of the light bulbs as more cells are added]* • **measuring** voltages across each resistor in series, and across the battery *[show that the sum of the voltages across the resistors adds up to the voltage across the battery].* Record measurements on the circuit diagram	• Circuit board • Cells/battery • Conductor (wire) • Resistors • Light bulbs or • LEDs • Voltmeter • Ammeter

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Series and parallel circuits *[continued...]*	**Series circuits** *[continued...]* • the current is the same when measured at any point in a given series circuit • the total current *decreases* with each resistor added in series to the circuit	*[**Note**: In order to measure voltage, a voltmeter must always be connected across (in parallel) a resistor or battery. However, to measure current, an ammeter needs to be connected in line (in series) with the resistor or battery]* • **measuring** the current at different points in a series circuit *[show that the current is the same when measured at any point in a given series circuit].* Record measurements on a circuit diagram	
		Parallel circuits • when ***cells*** (of same voltage) are connected in parallel, the voltage across them is the same as for one cell.	• **investigating** the effects of connecting more cells in parallel into the circuit *[observe the brightness of the light bulbs as more cells are added]*	
		• ***resistors*** can be connected in parallel in a circuit • the voltage is the same across each resistor connected in parallel • The total current through the battery is the same as the sum of the currents through the resistors	• **measuring** voltages across each resistor in parallel, and across the battery *[show that the voltage is the same across each resistor connected in parallel].* Record measurements on the circuit diagram	
		• the total current in the circuit *increases* with each resistor added in parallel	• **measuring** the total current through each of the resistors, and from the battery *[show that the sum of the currents through the resistors adds up to the total current in the circuit].* Record measurements on the circuit diagram	
		• the lighting system in our homes is usually connected in parallel. If one light bulb fuses (filament breaks), the rest of the lights remain on because they are each connected in their own parallel pathway, to the mains circuit • resistors are manufactured to have accurate resistances to control current • for two circuits with the same total voltage: - the current will be bigger in a circuit with low resistance - the current will be smaller in a circuit with high resistance	• **identifying** series and parallel circuits in electrical wiring in homes, cars and toys • **drawing** series and parallel circuit diagrams	

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
½ week	**Safety with electricity**	**Safety practices** • parallel connections can cause overload on mains circuits • circuit breakers, fuses and earth leakage systems are used as safety devices • many appliances have a 3-pin plug as a safety device to connect to the main circuit • the 3-pin plug has a live wire, neutral wire and an earth wire - the earth wire is connected to the metal case of the appliance, such as in a kettle. The earth wire is connected via the wall plug to an earth cable in the ground - the earth cable has almost zero resistance, so if the metal casing of an appliance becomes charged due to a fault, the charge is safely discharged to the ground • illegal connections to the ESKOM mains supply can be dangerous, and are regarded as energy theft	• **identifying** fuses, circuit breakers, earthing and earth leakage systems in real circuits, or on circuit diagrams • **practising** how to connect 3-pin plugs • **drawing** the plan for wiring a house: - each room should have its own light with a switch - the house should have a main switch and a fuse (to prevent overload) *[**Note:** It is not necessary to construct a model house]*	• Pictures or diagrams of wiring showing fuses, circuit breakers and earthing • Three-pin plugs • Screwdrivers
1 week	**Energy and the national electricity grid**	**Electricity generation** • a power station is a system for generating electricity • most power stations in South Africa use coal as a fuel to boil water • the steam from the water turns a turbine which turns a generator, which produces electricity • there are other alternative sources of energy besides coal, that can be used to drive turbines and generators including wind, falling water (hydroelectric), sun-heated steam, nuclear fission, waves in the sea **Nuclear power in South Africa** • a nuclear power station such as Koeberg in the Cape, uses radioactive fuel, the radioactivity produces heat by nuclear fission. The heat is then used to boil water to produce steam • the steam from the water turns a turbine which turns a generator, that produces electricity. The electricity is then channelled into the national electricity grid • spent nuclear fuel (nuclear waste) is still radioactive and remains so for many hundreds of years, therefore it needs to be properly disposed of so it is not a danger to life for years to come	• **researching** about alternative sources of energy that can be used to drive generators for the national grid. Compare them in terms of sustainability and environmental impact	• Pictures of power stations in southern Africa • Pictures of components of a power station • Video clips from the internet

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Energy and the national electricity grid *[continued...]*	**National electricity grid** • the national grid is a network of interacting parts (a system): change in one part of the grid affects other parts of the grid - power stations feed electrical energy into the national grid at high voltages - power lines carry electricity at high voltages - transformers step down the voltage for local distributors and consumers: 15% of energy is wasted due to heating of transmission lines and transformers *[No details are required of alternating current or step-down transformers]* • power surges and grid overload can disrupt the power supply		• Diagram showing the national electricity grid with main power stations
2 weeks	**Cost of electrical power**	**The cost of power consumption** • electrical power is the rate of electrical energy supply • electrical power is measured in units called watts (W) or kilowatts (kW) *[one watt of power is equal to one joule of energy supplied in a second (I watt = 1 joule per second)]* • consumers pay for the quantity of power they use - quantity of electrical power used is measured in kWh (kilowatt hours) - the cost to the consumer is calculated in the following way: cost = power rating of the appliance × the number of hours it was used × the unit price of electricity • the energy consumption of different appliances (such as incandescent and compact fluorescent lamps) varies • there are also alternative appliances/systems such as solar heating panels for heating water	• **examining** labels (in adverts, or real electrical appliances such as iron, stove, TV, radio, refrigerator), and - record in a table the power rating printed on the devices - calculate and record the **units of power** consumed by these different appliances in a given time period (kWh) *[different learners can calculate the consumption of different appliances]* - sequence the appliances from those which require the most power to those which require the least power • **calculating** how much money it will cost the consumer to run one of the appliances above for a given period *[show how to calculate the cost by multiplying the kWh by the unit cost of electricity* *(**Note**: The unit cost of electricity increases from time to time. Find out what the current unit cost of electricity is in your municipality for this calculation)* **OR** • **selecting** one appliance from the above appliances. Calculate how long a particular prepaid card will last if only that appliance is used • **discussing** the many careers in the energy sector, including electricians, electrical engineers, artisans, IT specialists for maintaining and improving the power grid	• Examples of electricity accounts that show electricity usage and cost

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
Assessment guidelines	This content and the associated concepts must be integrated with the aims and skills for Natural Sciences *(refer to **Section 2**)*. • Learners should read, write, draw and do practical tasks regularly • Evidence of learner's work, including assessments, should be kept in the learner's notebook School-based assessment (including practical tasks and class tests), checking for correctness, and providing constructive feedback should be done regularly. Allow for a maximum of 6 hours to be used for assessment throughout the term. For more detailed guidelines on assessment, *refer to **Section 4.***		**Check the Learner's knowledge and that they can**: • explain and demonstrate the two broad groups of forces • demonstrate and explain the similarities and differences between gravitational, magnetic and electrostatic forces • make a table of the differences between mass and weight • give the scientific explanation of how lightning occurs • construct a simple cell to provide electrical energy from chemical energy • measure voltages across resistors and the current through them accurately • give advantages and disadvantages for series and parallel circuits • draw and interpret various circuit diagrams • distinguish between series and parallel circuits in the wiring of the home, cars and toys and explain the differences • describe the national energy supply grid and the impact of electricity generation on the environment • calculate the energy consumption of various appliances in the home	

GRADE 9 TERM 4				
STRAND: PLANET EARTH AND BEYOND				
TIME	**TOPIC**	**CONTENT & CONCEPTS**	**SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS**	**EQUIPMENT AND RESOURCES**
1 week	**The Earth as a system**	**Spheres of the Earth** • the Earth can be understood as a complex system where all the parts (called spheres) interact with each other • four spheres interact on or near the surface of the Earth: - the lithosphere consists of solid rock and soil - the hydrosphere consists of water in all its forms - the atmosphere is a layer of gases around the Earth - the biosphere consists of all living plants and animals and their interactions with rocks, soil, air and water	• **drawing and labelling** the concentric layers of the inside of the Earth *[revision from Social Sciences Grade 7)* • **writing** to explain the interaction between the spheres (lithosphere, hydrosphere, atmosphere, biosphere)	• Textbooks and reference materials • Models or pictures of the Earth (globe)
2 weeks	**Lithosphere**	**Lithosphere** • the Earth consists of four concentric layers called the inner core, outer core, mantle and crust *(link to Grade 7 Social Sciences*) • the lithosphere ('lith' means 'rocks') has three layers: the solid outermost part of the mantle, the crust and the soil • different combinations of elements and compounds form minerals such as copper, gold and hematite (iron oxide) in the crust **The rock cycle** • the rock cycle is the natural continuous process in which rocks form, are broken down and re-form over long periods of time • there are three rock types: igneous, sedimentary and metamorphic rocks • the rock cycle can be explained in the following steps: - molten rock from the mantle (magma) pushes up through the crust - pools of magma cool down slowly in the crust to form igneous rocks, like granite - some magma escapes to the surface as a volcano - this magma cools down rapidly to form igneous rocks, like pumice stone	• **researching and reading** about what elements and compounds we get from the crust • **modeling** the formation of rock layers [*use brown and white slices of bread for alternate layers]* • **writing, and making labeled drawings** to explain the rock cycle • **collecting and identifying** different types of rocks from samples or pictures	• Samples of different rocks (if available) or pictures of different rocks • Pictures that show the rock cycle

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Lithosphere *[continued…]*	- rocks on the surface of the Earth are weathered by heat, cold, wind and water to form smaller particles - wind and water transport these particles to flood plains and the sea by erosion - the particles are laid down as sediments - the sediments are covered by more layers **The rock cycle** – explained in steps • the pressure of many layers turns the lower layers into sedimentary rock like sandstone • hot magma heats the surrounding rock and changes its chemical structure to form metamorphic rock like slate from shale or marble from limestone • some rock is pushed below the crust, melts and becomes magma again		

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
2 weeks	**Mining of mineral resources**	**Extracting ores** • people extract valuable minerals from the lithosphere • rock that contains high concentrations of a valuable mineral is called an ore • the ore is removed from the crust by mining • some minerals can be used in their natural form such as sand, potash, diamonds **Refining minerals** • some other minerals require a chemical or physical process to extract the required material such as iron from iron-ore (chemical) or gold from gold-ore (physical) • knowledge of iron and copper extraction is thousands of years old - iron ore was heated with charcoal to make lumps of iron - South African archaeological sites in KwaZulu Natal and Limpopo provide evidence for this • modern processes mix coke (a form of carbon made from coal) and other metals with iron to produce steel **Mining in South Africa** • there is large scale mining activity in South Africa • this activity has significant environmental impacts such as - creation of mine dumps - pollution of water resources - damage to places with high tourist or cultural heritage value - loss of farming and wild life environments	• **reading** about how metal is extracted from ore **OR** • **investigating / demonstrating** how lead is extracted from its ore by heating lead oxide on a carbon block **OR** • **illustrating** physical separation processes used in mining *[hand sorting or sifting stones from sand]* • **researching and writing** about a mining activity in South Africa. Describe the: - elements and compounds being mined - chemical and physical separation methods used - environmental impacts	• Video clips from the internet showing metals being extracted from ore • Pictures to show various methods of mining • Blow pipes • Lead oxide • Carbon blocks • Bunsen / spirit burners
2 weeks	**Atmosphere**	**Atmosphere** • the atmosphere is the mixture of gases held around the Earth by gravity • this mixture is known as air and consists of nitrogen (78%), oxygen (21%), carbon dioxide (less than 1%), and other gases, including water vapour (1%)	• **drawing** with labels and **writing** about the layers of the atmosphere to scale *[use a ruler to draw the scale accurately]*	• Video clips from the internet

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Atmosphere *[continued…]*	**Atmosphere** *[continued…]* • the density of the gas particles decreases as the distance from the Earth increases (the further away from the Earth, the thinner the air) • the atmosphere has four layers: troposphere, stratosphere, mesosphere, thermosphere • each layer has a different temperature gradient • temperature gradient is how much the temperature changes with height above sea level (altitude) **Troposphere** • this layer extends from sea level to about 10 km above the surface of the Earth • it contains more than 70% of the mass of the atmosphere (particles closest together) and it has the greatest density • the temperature decreases as the distance from the surface increases (the further away from the Earth, the colder the air) • weather occurs in this layer • all animals and plants live in this layer **Stratosphere** • this layer extends from about 10 km to about 50 km above the Earth's surface • the air in the stratosphere is very thin compared to the air in the troposphere • some aeroplanes fly as high as the stratosphere • the stratosphere includes a band of ozone gas (O_3) which absorbs ultraviolet radiation from the Sun • this absorption of ultraviolet radiation increases the temperature of the stratosphere - as a result, the further away from the Earth, the warmer the air becomes • too much ultraviolet radiation interferes with life on Earth (human health, photosynthesis, life cycles and sizes of populations of species)	• **calculating** the temperature at different heights above sea level in the troposphere (the temperature gradient is about 1°C per 100 metres in still air)	

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
	Atmosphere *[continued…]*	**Mesosphere** • this layer extends from about 50 – 80 km above the Earth's surface • the air is extremely thin and very cold • there is still enough air in this layer to burn up small rocks and dust entering from space • burning rocks are visible from the Earth and known as 'shooting stars' **Thermosphere** • this layer starts above 80 km from the Earth (the thermosphere slowly diminishes at about 350 km and space begins after that. Satellites orbit much further away) • the International Space Station (ISS), where astronauts work in space orbits the Earth at a height of about 370 km • the lowest part of the thermosphere absorbs ultraviolet radiation and dangerous X-rays from the Sun • it also reflects radio waves back to Earth for TV and radio broadcasts **The greenhouse effect** • the greenhouse effect is a natural phenomenon – it warms the atmosphere sufficiently to sustain life • greenhouse gases trap the ultraviolet radiation which then warms the air closest to the surface of the Earth (like inside a greenhouse) • the most common greenhouse gases are carbon dioxide, water vapour and methane • an increase in greenhouse gases leads to global warming • global warming is an increase in the average temperature of the atmosphere • global warming is a potentially life threatening problem on Earth. It can lead to: - climate change - rising sea levels - food shortages - mass extinctions	• **making** a model to show the greenhouse effect *[use clear plastic bags and thermometers]* • **investigating and reporting** on the impact of global warming	• Reference materials • Video clips from the internet showing the greenhouse effect • Pictures • Thermometers • Clear plastic bags

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
1 week	**Birth, life and death of stars**	**The birth of a star** • stars exist for a finite period of time • stars form inside huge clouds of gas and dust called *nebulae*, far out in space • these *nebulae* (huge amounts of dust and gas) are pulled together by gravity and slowly collapse • as they contract they heat up • once the temperature is high enough a nuclear fusion reaction begins, that changes hydrogen to helium • this reaction radiates large amounts of energy into space **Life of a star** • stars change in their appearance over billions of years • stars that look blue are hotter and usually younger than stars that appear red • our Sun is about half way through its life cycle – it is a medium-sized yellow star with a lifespan of about 9 billion years • for most of their life, stars change hydrogen to helium • later, towards the end of their life, stars like the Sun will swell up to form a 'red giant' **Death of a star** • at some point the nuclear reaction runs out of fuel • for stars like the Sun, the core of the star contracts to become a 'white dwarf' • for stars like the Sun, the outer gases of the star are ejected into space, where they form an expanding cloud around the white dwarf called a *planetary nebula* • *planetary nebulae* are lit up by their central white dwarf star and are beautiful objects to observe	• **observing** different coloured stars in the night sky • **sequencing, explaining and presenting** an information poster on the birth, life and death of stars	• Video clips and images from the internet

TIME	TOPIC	CONTENT & CONCEPTS	SUGGESTED ACTIVITIES: INVESTIGATIONS, PRACTICAL WORK, AND DEMONSTRATIONS	EQUIPMENT AND RESOURCES
Assessment guidelines	This content and the associated concepts must be integrated with the aims and skills for Natural Sciences *(refer to **Section 2**)*. • Learners should read, write, draw and do practical tasks regularly • Evidence of learner's work, including assessments, should be kept in the learner's notebook School-based assessment (including practical tasks and class tests), checking for correctness, and providing constructive feedback should be done regularly. As this is an exam term, the final two weeks may be required for revision. For more detailed guidelines on assessment, *refer to **Section 4.***		**Check the learner's knowledge and that they can**: • describe the Earth as a complex system of parts (spheres) that interact with each other • identify and describe igneous, sedimentary and metamorphic rocks • explain the main processes causing the cycle of the formation of rock • write about the processes of separating and extracting metals from ore • describe the atmosphere and its layers in detail • make a model to show the greenhouse effect • describe the impact of global warming • show their understanding of the birth, life and death of stars	

SECTION 4: ASSESSMENT

4.1 INTRODUCTION

Assessment is a continuous and planned process of identifying, gathering, interpreting and diagnosing, information about the performance of learners. All forms of assessment involve generating and collecting evidence of achievement; evaluating this evidence and using this information to understand and thereby assist the learner's development and the teaching process.

Assessment should be both *informal* and *formal*. In both cases regular feedback should be provided to learners to enhance the learning experience.

Informal and formal assessment

Informal assessment consists of regular checking of learners' class work (including practical tasks) asking questions orally and giving constructive feedback. Marks for informal assessment need not be recorded.

Formal assessment consists of selected assessment tasks, the marks of which should be recorded formally. These assessment tasks are done throughout the year and include tests, selected practical tasks or investigations and examinations. All marks that are recorded formally contribute to the final year mark.

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 learners' 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 out against the content (concepts and skills) and specific aims for Natural Sciences. In both informal and formal assessments it is important to ensure that in the course of a school year:

- all of the subject content is covered
- the full range of major skills is included. (See **Section 2.7** and **Section 4.5**)
- a variety of different forms of assessment is used. (See **Section 4.4**)

4.2 INFORMAL ASSESSMENT OR DAILY ASSESSMENT

The purpose of Informal assessment is to continuously collect information on a learner's achievement that can be used to improve their learning.

Informal assessment is a daily monitoring of learners' progress. It should not be seen as separate from the learning activities taking place in the classroom.

Informal assessment can be done through observation, discussion, practical demonstrations, informal classroom interactions, classwork, investigations and so on. Informal assessment may be as simple as stopping during the lesson to observe learners or to discuss with learners how learning is progressing. Informal assessment should also be used to provide feedback to the learners and to inform planning for teaching.

Self-assessment and peer assessment, as part of informal assessment, actively involves learners in assessment and a teacher playing an overseeing role. This is important as it allows learners to learn from and reflect on their own performance.

Selected informal assessment tasks may be marked by learners or teachers, but need not be recorded unless the teacher wishes to do so. The results of daily assessment tasks are not taken into account for promotion and certification purposes, but for improving teaching and learning.

Informal, on-going assessments should be used to encourage the acquisition of knowledge and skills and should be the stepping stones leading up to the formal tasks in the Programme of Formal Assessment. *(See **Section 4.4**)*

4.3 FORMAL ASSESSMENT

Formal assessment tasks and tests form part of a year-long formal Programme of Assessment in each Grade and subject. Formal assessments are marked and recorded by the teacher for progression purposes. All Formal Assessment tasks must be moderated for the purpose of quality assurance and to ensure that appropriate standards are maintained.

Formal assessment provides teachers with a systematic way of evaluating how well learners are progressing in a Grade and in a particular subject. Formal assessment tasks in Natural Sciences are tests, examinations, selected practical tasks or investigations and a project. The project may be done at any time during the year, but the marks must be recorded in the 4th term. *(See details in **Section 4.4**)*

The School-based assessment component in the different phases is as follows:

Grades	Formal school-based	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 and 'trial' examinations	External examination: 75%

Formally assessed tests and practical tasks/investigations must together reflect the whole term's work. Weighting of marks should reflect time allotted to each section in the curriculum content.

The cognitive demands of assessment

The cognitive demands of assessment used should be appropriate to the age and developmental level of the learners in the grade. Assessments in Natural Sciences must cater for a range of cognitive levels and abilities of learners within this context. The assessment tasks should be carefully designed to cover the content of the subject as well as the range of major skills that have been specified under the Process skills (*See **Section 2.7**)*

The Specific Aims, the topics and content and the range of major skills must be used to inform the planning and development of assessment tasks.

Cognitive levels for the assessment of content in Grades 7, 8 and 9

Setting tests and tasks for different cognitive levels	Knowing science	Understanding science	Applying scientific knowledge	Evaluating, analyzing, synthesising scientific knowledge
Percentages indicating the proportion of low, middle and high order questions in tasks, tests and exams	**Low order questions 40%**	**Middle order questions 45%**		**High order questions 15%**
Useful verbs to use when setting questions	State Name Label List Define Describe and others ...	Explain Compare Rearrange Illustrate Give an example Calculate Make a generalisation and others …	Predict Apply Use knowledge to demonstrate Solve Implement Judge and others …	Select Differentiate Analyse Infer Suggest a reason Interpret Discuss Categorise and others ...

These cognitive skills apply to all three Specific Aims for Natural Sciences. *(See **Section 2.6**)*

4.4 FORMAL ASSESSMENT REQUIREMENTS FOR NATURAL SCIENCES

In any formal assessment, learners should be made aware of what will be assessed and how that will be assessed.

Grades 7, 8 and 9

FORMAL ASSESSMENTS	TERM 1	TERM 2	TERM 3	TERM 4	TOTAL % FOR THE YEAR
School-based assessments	Test 1 *Practical task/ Investigation 1	Test 2 *Practical task/ Investigation 2	Test 3 *Practical task/ Investigation 3	*Practical task/ Investigation 4 ***Project	40%
Exams		**Exam 1 on work from terms 1 & 2		**Exam 2 on work from terms 3 & 4	60%
Number of formal assessments	2	3	2	3	Total: 100%

Notes: * Grade appropriate assessment on aspects of investigation processes should form part of the selected practical tasks in the assessment programme for the year

** Content, concepts and skills across all the topics, including knowledge of investigations and some skills associated with practical work must be assessed in the written exams

*** The project can be done at any time of the year but it is incorporated in the 4th term mark

A note on tests and examinations

Tests and examinations consist of a range of questions that cover the different cognitive levels – knowing science, understanding and applying scientific knowledge, evaluating, analysing and synthesising. (*See percentages indicating the weighting of* ***Cognitive levels for the assessment of content*** *under* ***Section 4.3***). The weighting of marks should reflect time allotted to each section in the curriculum content.

A single formal class test in a term will not necessarily provide the most accurate and reliable evidence of every learner's performance. One formal class test in the first three terms is the minimum number that must be recorded.

Learners are required to respond to questions within a specified time under controlled conditions. Since they are generally easy to mark reliably, they are a good way to conduct formal assessment, and can also be a useful informal assessment tool. Examinations are similar to tests; the only difference is that they cover more content.

A note on practical tasks

In carrying out practical tasks learners are required to demonstrate their skills or proficiencies. Learners use materials and equipment to create, produce or investigate something. The teacher observes the learner demonstrate specific practical skills (e.g. measuring the height of a plant, manipulating materials to make models, using a thermometer to measure temperature, etc.). Practical tasks can be very useful for assessing how learners draw on knowledge and values to carry out practical skills (manual and/or behavioural, e.g. safety and handling of equipment).

Any practical task should provide opportunities for learners to demonstrate several different skills - see those listed under ***Section 2.7***. These may or may not include **investigation skills.** 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.

Practical tasks include a range of activities where learners communicate what they know and can do. Include a range of tasks to ensure inclusivity and to accommodate different learning styles. These ways to communicate include: acting out, speaking/discussing, drawing, making models, doing science practical work, working in the environment, writing and doing calculations.

Assessment of practical tasks

The assessment may be based on the end-result of the activity (the product), or the carrying-out of the activity (the process), or a combination of both. Assessment tools of projects could be a combination of rubric, memorandum, checklist, etc.

A note on projects

Projects are tasks in which learners illustrate or apply knowledge that they have gained in class. Projects may involve aspects of investigation and/or research. Learners may collect data to understand a particular set of circumstances and/or phenomena. In doing this, they can build models, compile reports, essays or posters and even give presentations. Learners can do projects individually or in groups or working alone, but with some support and guidance from the teacher. The teacher directs the choice of the project, usually by providing the learners with a topic or brief for the investigation.

Assessment of projects

Teachers can assess different stages of projects separately, or the entire project. Assessment of projects should be based on the understanding of content, application of skills and values applicable in a relevant context and may vary in extent. Projects may be done in class and should be sufficiently diverse to promote inclusivity. Assessment tools of projects could be a combination of rubric, memorandum, checklist, etc. One project per year must be done in the Senior Phase. It can be done in any term, but the marks must be recorded in term 4.

4.5 RECORDING AND REPORTING

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

Guidelines on how the major process skills can be recorded for marks in Natural Sciences

Many of these major process skills *(also refer to **Section 2.7**)* are combined into one activity. Not every major skill needs to be marked and recorded in each task.

Natural Sciences major investigation process skills	Mark allocation
Writing the topic	
Raising/ writing a question to investigate	
Making a prediction/ hypothesis	
Planning the investigation	
Collecting data	
Recording data	
Evaluating and communicating results	
Total	

4.5.2 Reporting is a process of communicating learner performance to learners, parents, schools, and other stakeholders. Learner performance can be reported in a number of ways. These include report cards, parents' meetings, school visitation days, parent-teacher conferences, phone calls, letters, class or school newsletters, etc.

Teachers will record actual marks against the task by using a record sheet; and report percentages against the subject on the learners' report cards. Percentages are reported and may be related to the 7-point rating code. *(See **Section 4.5.4)***

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

4.5.3 Mark allocation

A minimum mark allocation is prescribed for the tests, tasks, project and examinations for each Grade in the Senior Phase.

For purposes of reporting, the marks for the assessment tasks of each term must be combined to create a mark out of 100 (a percentage). For Term 2 and for the overall year mark (calculated at the end of Term 4), the school based assessments and examinations should be combined in the ratio **40:60.**

See the examples for each Grade below.

GRADE 7 (Example based on minimum prescribed marks)

FORMAL ASSESSMENTS	TERM 1	TERM 2	TERM 3	TERM 4	TOTAL % FOR THE YEAR
School-based assessments	Test 1 (30 marks) Practical task / Investigation 1 (20 marks)	Test 2 (30 marks) Practical task / Investigation 2 (20 marks)	Test 3 (30 marks) Practical task / Investigation 3 (20 marks)	Practical task / Investigation 4 (20 marks) Project (20 marks)[1]	40%
Exams		Exam 1 on work from terms 1 & 2 (60 marks)		Exam 2 on work from terms 3 & 4 (60 marks)	60%
Number of formal assessments	2	3	2	3	Total: 100%

1. Calculating the marks for each term:

Term 1 (%) = (Test 1 mark + Practical task 1 mark) ÷ (30 + 20) × 100

Term 2 (%) = (Test 2 mark + Practical 2 mark) ÷ (30 + 20) × 40 + (Exam 1 mark ÷ 60) × 60

Term 3 (%) = (Test 3 mark + Practical 3 mark) ÷ (30 + 20) × 100

Term 4 (%) = Final year mark *(see number 4 below)*

2. Calculating the School-based assessment mark:

School-based assessment mark = (Test 1 mark + Test 2 mark + Test 3 mark + Practical 1 + Practical 2 mark + Practical 3 mark + Practical 4 mark + Project mark) ÷ (30 + 30 + 30 + 20 + 20 + 20 + 20 + 20) × 100

3. Calculating the Exam mark:

Exam mark = (Exam 1 mark + Exam 2 mark) ÷ (60 + 60) × 100

4. Calculating the Final year mark:

Final year mark = (School based assessment mark × 0,4) + (Exam mark × 0,6)

Percentages are reported and may be related to the 7-point rating code as given below.

GRADE 8 (Example based on minimum prescribed marks)

FORMAL ASSESSMENTS	TERM 1	TERM 2	TERM 3	TERM 4	TOTAL % FOR THE YEAR
School-based assessments	Test 1 (35 marks) Practical task / Investigation 1 (20 marks)	Test 2 (35 marks) Practical task / Investigation 2 (20 marks)	Test 3 (35 marks) Practical task / Investigation 3 (20 marks)	Practical task / Investigation 4 (20 marks) Project (30 marks)[2]	40%
Exams		Exam 1 on work from terms 1 & 2 (70 marks)		Exam 2 on work from terms 3 & 4 (70 marks)	60%
Number of formal assessments	2	3	2	3	Total: 100%

1. Calculating the marks for each term:

Term 1 (%) = (Test 1 mark + Practical task 1 mark) ÷ (35 + 20) × 100

Term 2 (%) = (Test 2 mark + Practical 2 mark) ÷ (35 + 20) × 40 + (Exam 1 mark ÷ 70) × 60

Term 3 (%) = (Test 3 mark + Practical 3 mark) ÷ (35 + 20) × 100

Term 4 (%) = Final year mark *(see number 4 below)*

2. Calculating the School-based assessment mark:

School-based assessment mark = (Test 1 mark + Test 2 mark + Test 3 mark + Practical 1 + Practical 2 mark + Practical 3 mark + Practical 4 mark + Project mark) ÷ (35 + 35 + 35 + 20 + 20 + 20 + 20 + 30) × 100

3. Calculating the Exam mark:

Exam mark = (Exam 1 mark + Exam 2 mark) ÷ (70 + 70) × 100

4. Calculating the Final year mark:

Final year mark = (School based assessment mark × 0,4) + (Exam mark × 0,6)

Percentages are reported and may be related to the 7-point rating code as given below.

GRADE 9 (Example based on minimum prescribed marks)

FORMAL ASSESSMENTS	TERM 1	TERM 2	TERM 3	TERM 4	TOTAL % FOR THE YEAR
School-based assessments	Test 1 (40 marks) Practical task / Investigation 1 (20 marks)	Test 2 (40 marks) Practical task / Investigation 2 (20 marks)	Test 3 (40 marks) Practical task / Investigation 3 (20 marks)	Practical task / Investigation 4 (20 marks) Project (50 marks)[3]	40%
Exams		Exam 1 on work from terms 1 & 2 (80 marks)		Exam 2 on work from terms 3 & 4 (80 marks)	60%
Number of formal assessments	2	3	2	3	Total: 100%

1. Calculating the marks for each term:

Term 1 (%) = (Test 1 mark + Practical task 1 mark) ÷ (40 + 20) × 100

Term 2 (%) = (Test 2 mark + Practical 2 mark) ÷ (40 + 20) × 40 + (Exam 1 mark ÷ 80) × 60

Term 3 (%) = (Test 3 mark + Practical 3 mark) ÷ (40 + 20) × 100

Term 4 (%) = Final year mark *(see number 4 below)*

2. Calculating the School-based assessment mark:

School-based assessment mark = (Test 1 mark + Test 2 mark + Test 3 mark + Practical 1 + Practical 2 mark + Practical 3 mark + Practical 4 mark + Project mark) ÷ (40 + 40 + 40 + 20 + 20 + 20 + 20 + 50) × 100

3. Calculating the Exam mark:

Exam mark = (Exam 1 mark + Exam 2 mark) ÷ (80 + 80) × 100

4. Calculating the Final year mark:

Final year mark = (School based assessment mark × 0,4) + (Exam mark × 0,6)

Percentages are reported and may be related to the 7-point rating code as given below.

4.5.4 Codes and percentages for reporting in Grades R – 12

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

4.6 MODERATION OF ASSESSMENT

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

In Grades 7, 8 & 9 the formal School-based assessment (including the practical assessment tasks) should be moderated by the relevant subject specialist(s) at district level and if necessary at provincial level in consultation with the moderators at school. Moderation serves the following purposes:

1. It should ascertain whether the subject content and skills have been taught and assessed. (sufficiently covered)
2. It should ensure that the correct balance of cognitive demands is reflected in the assessment.
3. It should ensure that the assessments and marking are of an acceptable standard and consistency.
4. It should identify areas in which the teacher may need further development and should lead to support for such development.
5. It should reflect the scope covered by the teacher in line with the term's requirement.

Moderation is therefore an ongoing process and not a once-off event at the end of the year. There is no national moderation in the Senior Phase.

4.7 GENERAL

This document should be read in conjunction with:

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

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

(Footnotes)

1 (NB – the project can be done at any time of the year but it is incorporated in the 4th term mark)

2 (NB – the project can be done at any time of the year but it is incorporated in the 4th term mark)

3 (NB – the project can be done at any time of the year but it is incorporated in the 4th term mark)