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Successful

Natural Sciences

TEACHER'S GUIDE

GRADE 8

WITH EXAM INFO AND EXEMPLAR PAPERS

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Section 1 Introduction

How this course works

This Natural Sciences course is part of a series that meets the requirements of the Curriculum and Assessment Policy Statement (CAPS) for the Senior Phase. The series consists of two core components each for Grade 8: a Learner's Book and a Teacher's Guide.

The Learner's Book

The full-colour Learner's Book provides content knowledge, core concepts and skills development. It includes activities for learners to develop, practise and consolidate their knowledge and skills. Teachers receive guidance on how to teach important concepts. Written texts are supported by illustrations that help to explain content. All examples, activities and illustrations are representative of all cultural groups.

Activities steadily become more challenging so that learners progressively develop their understanding of concepts.

The Teacher's Guide

The Teacher's Guide provides you, the teacher, with all the planning, teaching and assessment tools you need to successfully teach this subject.

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How this Teacher's Guide should be used

The Teacher's Guide supports you by:

- defining subject, the National Curriculum and Assessment Policy Statement (CAPS) and teaching terminology
- indicating pacing, content and resources in content overviews, and structuring the course into lessons with clear teaching guidelines according to the CAPS
- providing background information (prior knowledge and skills covered in previous grades and/or interesting subject/topic background
- providing suitable remediation and extension activities for each lesson
- providing suggested answers for every activity
- providing Formal Assessment Tasks and marking guidelines and rubrics as required by the CAPS
- providing the chapter and unit at the bottom of the page to enable easy referencing between components
- offering additional resources that support core content.

An overview of the Natural Sciences Curriculum and Assessment Policy Statement

This series is based on the National Curriculum Statement Grades R–12 (NCS, January 2012) which is the policy document for learning and teaching in South Africa. The NCS consists of three documents, namely:

- *Curriculum and Assessment Policy Statements* (CAPS) for all approved subjects for Grades R–12
- *National Policy pertaining to the Programme and Promotion Requirements of the National Curriculum Statement Grades R–12*
- *National Protocol for Assessment Grades R–12* (January 2012).

The CAPS document for Natural Sciences has four sections:

- Section 1 – Introduction to the Curriculum and Assessment Policy Statements
- Section 2 – Overview of Natural Sciences, time allocations and requirements to offer it as a subject
- Section 3 – Overview of topics, annual teaching plan and content clarification

Section 4 – Assessment guidelines in Natural Sciences

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Sections 2, 3 and 4 of the CAPS document, together with the National Policy pertaining to the Programme and Promotion Requirements of the NCS, represent the norms and standards of the National Curriculum Statement Grades R–12. Together these documents are the basis for determining minimum outcomes, processes and procedures for the assessment of learner achievement in public and independent schools.

An overview of Natural Science

The overview of content given in Section 2 of the Natural Sciences CAPS provides a useful summary of what Natural Sciences as a subject aims to teach learners:

- photosynthesis and respiration
- interactions and interdependence within the environment
- micro-organisms
- atoms
- particle model of matter
- chemical reactions
- static electricity
- energy transfer in electrical systems
- series and parallel circuits
- visible light

- the Solar System
- beyond the Solar System
- looking into space

Source: Curriculum and Assessment Policy Statement, Natural Sciences Grades 7-9, 2011

Instructional time allocation

The instructional time in the Senior Phase is as follows:

Subject	Teaching hours per week	Total per term
Home Language	5	50
First Additional Language	4	40
Mathematics	4,5	45
Natural Sciences	3	30
Social Sciences	3	30
Technology	2	20
Economic Management Sciences	2	20
Life Orientation	2	20
Creative Arts	2	20
Total	**27,5**	**27,5**

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This table shows that the teaching time for Natural Sciences is allocated 3,5 hours per week.

Requirements for teaching and learning Natural Sciences

At the end of Section 2, the CAPS for Natural Sciences specifies that each learner should be equipped with a textbook, sufficient workspace essential equipment (including tools, apparatus materials and consumables) required for carrying out investigations and for the designing and making of things. Every teacher must have a textbook and a teacher's guide.

This course provides the Learner's Book as the textbook for learners and teachers. This guide is the accompanying teacher's guide for teachers. In the term plans for teaching Natural Sciences (Section 4 of this guide) we suggest additional resources that teachers will find useful in the classroom to teach the subject.

Section 2 Planning and assessment

Overview of Strands

There are 56 topics in total in the Natural Sciences curriculum across Grade 8. These topics are organised into 4 main topic areas: Life and living, Matter and materials, Energy and change, and Planet Earth and beyond. The following table shows how the topics are spread across Grade7, 8 and 9:

	GRADE 7		GRADE 8		GRADE 9	
TERM	**TOPIC**	**TIME IN WEEKS**	**TOPIC**	**TIME IN WEEKS**	**TOPIC**	**TIME IN WEEKS**
Term 1 Natural Sciences Life and Living	The biosphere	1	Photosynthesis and respiration	2	Cells as the basic units of life	2
	Biodiversity	3,5	Interactions and interdependence within the environment	5	Systems in the human body	2
	Sexual Reproduction	2			Human reproduction	2
	Variation	1	Micro-organisms	2	Circulatory and respiratory systems	2
					Digestive system	1,5
		(9 weeks)		**(9 weeks)**		**(9 weeks)**
Term 2 Natural Sciences: Matter and materials	Properties of materials	2	Atoms	2	Compounds	1
	Separating mixtures	2	Particle model of matter	5	Chemical reactions	1
	Acids, bases and neutrals	2	Chemical reactions	1	Reactions of metals with oxygen	1,5
	Introduction to the Periodic Table of Elements	2			Reactions of non-metals with oxygen	1,5
					Acids, bases, and pH value	1
					Reactions of acids with bases: Part I	1
					Reactions of acids with bases: Part II	0,5

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		(8 weeks)		**(8 weeks)**	Reactions of acids with bases: Part III Reactions of acids with metals	0,5 0,5 **(8 weeks)**
Term 3 Natural Sciences: Energy and Change	Sources of energy Potential and kinetic energy Heat transfer Insulation and energy saving Energy transfer to surroundings The national electricity supply system	1 2 2 2 1 1 **(9 weeks)**	Static electricity Energy transfer in electrical systems Series and parallel circuits Visible light	1 3 2 3 **(9 weeks)**	Forces Electric cells as energy systems Resistance Series and parallel circuits Safety with electricity Energy and the national electricity grid Cost of electrical power	2 0,5 1 2 0,5 1 2 **(9 weeks)**
Term 4 Natural Sciences: Planet Earth and beyond	Relationship of the Sun to the Earth Relationship of the Moon to the Earth Historical development of astronomy	4 2 2 **(8 weeks)**	The Solar System Beyond the Solar System Looking into space	1 3 2 **(8 weeks)**	The Earth as a system Lithosphere Mining of mineral resources Atmosphere Birth, life and death of stars	1 2 2 2 1 **(8 weeks)**

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Teaching plan for Natural Sciences Grade 8

This teaching plan shows:

- the pacing of the topics for the course by term
- where to find the relevant content and activities in the Learner's Book
- when Formal Assessment takes place, cross-referenced to suitable activities in the Learner's Book.

Note: On this table, "LB" means the Learner's Book and "TG" means this Teacher's Guide.

Term 1						
Week	**Strand**	**Unit**	**Contents**	**LB pages**	**TG pages**	**Formal assessment**
1	1	Unit 1	Photosynthesis and respiration: Photosynthesis	12	30	
2	1	Unit 2	Photosynthesis and respiration: Respiration	16	32	
3–4	1	Unit 3	Interactions and interdependence within the environment: Introduction to ecology	20	34	
4–5	1	Unit 4	Interactions and interdependence within the environment: Feeding relationships	26	37	
5–6	1	Unit 5	Interactions and interdependence within the environment: Energy flow: Food chains and food webs	30	39	
6–7	1	Unit 6	Interactions and interdependence within the environment: Balance in an ecosystem	34	42	
7–8	1	Unit 7	Interactions and interdependence within the environment: Adaptations	38	44	
8	1	Unit 8	Interactions and interdependence within the environment: Conservation of the ecosystem	44	46	
9	1	Unit 9	Micro-organisms: Types of micro-organisms	48	49	
9	1	Unit 10	Micro-organisms: Harmful micro-organisms	52	51	
9	1	Unit 11	Micro-organisms: Useful micro-organisms	56	53	
9	Formal assessment		Strand 1 Exemplar test	61	56	✓

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Term 2						
Week	**Strand**	**Unit**	**Contents**	**LB pages**	**TG pages**	**Formal assessment**
1	2	Unit 1	Atoms: The building blocks of matter		59	
1	2	Unit 2	Atoms: Sub-atomic particles		59	
2	2	Unit 3	Atoms: Elements and compounds		61	
2–3	2	Unit 4	Particle model of matter: The concept of the particle model of matter		64	
3–4	2	Unit 5	Particle model of matter: Diffusion		66	
4–5	2	Unit 6	Particle model of matter: Change of state		68	
5–6	2	Unit 7	Particle model of matter: Density, mass and volume		69	
6–7	2	Unit 8	Particle model of matter: Expansion and contraction		73	
7–8	2	Unit 9	Particle model of matter: Pressure		74	
8	2	Unit 10	Chemical reactions: Reactants and products		76	
8	Formal assessment		Strand 2 Exemplar test		80	
	Formal assessment		Strand 2 Exemplar mid-year exam (Term 1 and 2)		81	

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Term 3						
Week	**Strand**	**Unit**	**Contents**	**LB pages**	**TG pages**	**Formal assessment**
1	3	Unit 1	Static electricity: Friction and static electricity	102	84	
2	3	Unit 2	Energy transfer in electrical systems: Circuits and current electricity	106	85	
3	3	Unit 3	Energy transfer in electrical systems: Components of a circuit	408	86	✓
4	3	Unit 4	Energy transfer in electrical systems: Effects of an electric current	112	87	
4–5	3	Unit 5	Series and parallel circuits: Series circuits and parallel circuits	118	91	✓
5–6	3	Unit 6	Series and parallel circuits: Output devices in complex circuits	124	96	
6–7	3	Unit 7	Series and parallel circuits: History of electricity and careers in electricity	126	96	
7	3	Unit 8	Visible light: Radiation of light	130	98	
8	3	Unit 9	Visible light: The visible spectrum	134	100	
8	3	Unit 10	Visible light: Opaque and transparent substances	134	101	

Term 3						
Week	**Strand**	**Unit**	**Contents**	**LB pages**	**TG pages**	**Formal assessment**
8	3	Unit 11	Visible light: Absorption and reflection of light	141	103	
9	3	Unit 12	Visible light: Seeing light	146	106	
9	3	Unit 13	Visible light: Refraction of light	148	107	
9	3	Unit 14	Visible light: Careers in optics, physics and fibre optics	156	111	
9	Formal assessment		Strand 3 Exemplar test	159	112	

Term 4						
Week	**Strand**	**Unit**	**Contents**	**LB pages**	**TG pages**	**Formal assessment**
1	4	Unit 1	The Solar System: The Sun	164	116	
1	4	Unit 2	The Solar System: Objects around the Sun	166	117	✓
1	4	Unit 3	The Solar System: Earth's position in the Solar System	172	125	
2	4	Unit 4	Beyond the Solar System: The Milky Way galaxy	174	127	
2	4	Unit 5	Beyond the Solar System: Our nearest star	178	129	
3	4	Unit 6	Beyond the Solar System: Light years, light hours and light minutes	180	129	
4	4	Unit 7	Beyond the Solar System: Beyond the Milky Way galaxy	182	131	
5	4	Unit 8	Looking into space: Early viewing of space	184	133	✓
6	4	Unit 9	Looking into space: Telescopes	188	138	
7–8	Formal assessment		Strand 4 Exemplar test	195	143	
	Formal assessment		Strand 4 Exemplar end-of-year exam (Term 3 and 4)	196	144	

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Assessment in the Senior Phase

Assessment is about collecting evidence of the learners' learning. It is an integral part of teaching and learning, and should be planned when planning the lesson content. Assessment helps to identify the needs of the learners. It also provides evidence of progress, enables teachers to reflect on what they are doing and provides for feedback

and reporting to all stakeholders. Good assessment practice in Natural Sciences includes:

- assessing whether skills and aims are applied to content knowledge
- determining whether learners can apply this knowledge to procedures and problems
- providing feedback.

The four steps of assessment:

1. Generating and collecting evidence of achievement
2. Evaluating the evidence
3. Recording the findings
4. Using the findings to guide future learning and teaching.

Types of assessment

Type of assessment	Description
Baseline assessment	Establishes whether learners meet basic skills and knowledge level required Helps teacher plan for the year and for each learner Is administered at the beginning of the year and before a particular topic Results are used as a guide for teaching and not for promotion purposes.
Diagnostic assessment	Informs the teacher about certain specific problem areas that may hinder performance May help determine whether a learner's problems are content or psycho-social based Appropriate interventions should follow on from diagnostic assessment Results should inform interventions and not be used for promotion purposes.
Formative assessment	Used to aid the learning process and not for promotion purposes Usually informal, to provide the teacher and learner with a more frequent account of where the learner is at Teachers can use this form of assessment to modify and adapt their own teaching.
Summative evaluation	Carried out after completion of a topic or cluster of topics Is an assessment of learning that has taken place Recorded and used for promotion This is usually formal assessment, making up the Formal Programme of Assessment.

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Informal or daily assessment

Informal assessment is a daily monitoring of learners' progress. This is done through observations, discussions, practical demonstrations, learner-teacher conferences, informal classroom interactions, and so on. The Learner's Book is packed with activities that can be used for informal assessment, once learners have mastered the basic concepts.

The CAPS tells us that informal assessment should be used to provide feedback to the learners and to inform planning for teaching, but need not be recorded or taken into account for promotion. It should not be seen as separate from learning activities taking place in the classroom. Learners or teachers can mark these assessment tasks.

Self-assessment and peer assessment actively involve learners in assessment. This is important as it allows learners to learn from and reflect on their own performance. Learners often experience difficulty completing extended writing. Learners should read and write regularly; starting with sentences and paragraphs and building up to extended pieces of work. Much of this may be structured by working through activities.

Formal assessment

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

The forms of assessment used should be appropriate for the learners' ages and developmental levels. Learners must complete formal assessments each term. Formal assessment provides teachers with a systematic way of evaluating how well learners are progressing in a grade and in a particular subject. Examples of formal assessments include tests, examinations, practical tasks, projects, oral presentations and posters. Formal assessment tasks form part of a year-long formal Programme of Assessment in each grade and subject.

Formal Programme of Assessment for Natural Sciences

Learners' marks for formal assessment are partly derived from their year mark for school-based assessment (SBA, 75%), and partly from their final examination mark (25%). This course provides a full formal Programme of Assessment aligned with the plan given on the Natural Sciences CAPS.

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The table below presents the formal assessment opportunities in this Grade 8 course and shows the breakdown between SBA and the final examination:

GRADE 8 (Example based on minimum prescribed marks)

FORMAL ASSESSMENTS	TERM 1	TERM 2	TERM 3	TERM 4	TOTAL
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]	40%
Exams		Exam 1 on		Exam 2 on	

		work from terms 1 & 2 [70 marks]		work from terms 3 & 4 [70 marks]	60%
Number of formal assessments	2	3	2	3	Total: 100%

Formal assessment tasks in Natural Sciences Grade 8			
Strand	**Tasks**	**Options**	**Page**
1 Life and living	Practical task	Show that green leaves produce starch	31
		Investigate the growth of yeast under different conditions	54
	Exemplar test	Content Term 1	56
	Project	Find out more about a scientist's contribution to modern medicine	54
2 Matter and materials	Practical task	Compare and calculate the density of different materials	71
	Exemplar test	Content Term 2	80
	Exemplar mid-year exam	Exemplar mid-year exam	81
3 Energy and change	Practical task	Investigate the effect of more resistors in a series circuit	92
		Investigate effects of more resistors in a parallel circuit	93
	Project	How to make a ray box	
	Exemplar test	Content Term 3	112
4 Planet Earth and beyond	Practical task	Construct a scale model of the Solar System	121
		Record the position of the Southern Cross	136
	Exemplar test	Content Term 3	143
	Exemplar end-of-year exam	Content Term 3 and 4	144

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Practical guidelines for assessing the forms of formal assessment for Natural Sciences

Assessment tasks should be designed to cover the content and concepts of the subject and include a variety of activities selected to assess the identified aims and skills.

Before handing out an assessment task to learners, teachers should ensure that they are able to answer all the questions themselves. When teachers set an assessment task, they should draw up a memorandum of answers and/or a rubric or the assessment. Refer to the seven-point rating code or scale of achievement in this Teacher's Guide when constructing a rubric.

Feedback should acknowledge strengths and identify areas of weakness for learners' developmental needs. Action plans on how learners will be supported should accompany

this feedback. It is important that the feedback provided to learners encourages them to do better, and builds their self-confidence.

Tests and examinations

These are individual assessment tasks. Tests and examinations for formal assessment should be conducted under controlled conditions. This means that they should be completed by all classes in the same grade on the same day, and that all learners in the same grade write the same Natural Sciences paper under examination conditions. All questions must comply with the year-end examination standards.

Tests are written in Terms 1 and 3 and each must cover work done in the particular term. In Grade 8, learners must be given 40 minutes to complete the Term 1 test out of 15 marks. Learners write an hour-long mid-year examination out of 45 marks in Term 2. This examination must cover work done in Terms 1 and 2. The final examination at the end of Term 4 is based on work done in Terms 3 and 4. This examination is out of 45 marks in Grade 8 and learners must be given one hour to complete it.

Tests and examinations should include a variety of question styles. The CAPS for Natural Sciences presents a detailed format for the final examination. This format shows that Section A should cover all topics and include a variety of short question styles, such as multiple-choice questions, matching exercises and filling in missing words. After Section A there should be separate sections on each of the topic areas covered in the teaching period being tested or examined. For example Section B of the final examination must only have two or three questions on Energy and change. A variety of question types for these sections is also suggested: short-answer questions, paragraph-style questions, diagrams, cartoons, graphs, scenarios and case studies.

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All tests and examinations should take their lead from this format for the final examination in the CAPS. This will help learners gain confidence while developing and consolidating examination writing skills. In the Learner's Book under 'Examination Preparations', this course provides learners with general examination writing skills and advice on how to approach particular question types.

Each test and examination must cater for a range of cognitive levels in the correct allocation (see the table below).

Setting tests and tasks for different cognitive levels	Knowing Science	Understanding Science	Applying Scientific knowledge	Evaluating, analyzing, synthesising scientifc Knowledge
Percentages indicating the proportion of low, middle	Low order questions 40%	Middle order questions 45%		High order questions 15%

and high order questions in tasks, tests and exams				
Useful verbs to use when setting questions	State Name Label List and others	Explain Describe Compare Plan Rearrange Give an example and others	Predict Compare Design Use knowledge to demonstrate and others…	Evaluate Suggest a reason Interpret and others…

Cognitive level	Description of skill to be demonstrated	Weighting %
Lower order	Assessing knowledge and remembering	30
Middle order	Assessing understanding and application	40
Higher order	Analysing, evaluating and creating	30

In the 'Examination Preparations' section of the Learner's Book as well as in Section E of this guide, this course presents the terminology that will help to introduce questions pitched at the appropriate cognitive level. Learners should get as much exposure to these words as possible before tackling formal assessments. The activities of the Learner's Book are all structured using these instruction verbs. Their definitions on first use in each unit are explained on the page to help grow learners' familiarity with the terminology which they will encounter in formal assessments.

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Projects

Certain practical activities are recommended as suitable for possible projects, in which case the mark should be included as part of the School-based assessment. A project is optional and varies in extent. It may be done in class and should be sufficiently diverse to promote inclusivity.

Learners complete four projects in Natural Sciences in each grade. Projects are of a longer duration than other assessment tasks and learners need to be given enough time to complete them. Learners should be given the necessary guidance before they start with the project and their progress must be monitored throughout the project.

Be wary of prescribing projects that are beyond the cognitive level of the learners, or that will simply involve duplicating facts and data from reference material. The teacher should give clear criteria and instructions to guide learners. Determine which resources will be required and ensure that learners will have access to those resources. Learners must know the due date and how marks will be assigned.

Projects can be used to test a range of skills and competencies. A project should require learners to solve a problem. Learners will need to show these skills:

- planning, preparation, investigation and researching
- performing the task to a set of criteria
- producing a product such as a presentation or a written report with introduction, main body, conclusion and recommendations
- some application of their knowledge, innovation and creativity.

Assignments

An assignment is an individual task, similar to tests and examinations. However, the assignment should be an extended piece of work with a focus on more demanding work than that covered in class. The assignment can include past questions, but should also include more challenging aspects encouraging the learner to use additional material to help them. The assignment can be completed at home.

Case studies and data responses

With case studies learners are presented with a real-life situation, a problem or the description of an incident related to the topic. The text for case studies can come from various media sources such as newspaper and magazine articles, television or radio presentations. Case studies are a very good way of keeping the subject up to date and relevant.

Learners have to read or listen to the case study before answering the questions that are both based on and related to the content. Questions can be from lower order questions when learners respond to or provide direct quotes from the article, to higher order questions when they are asked to analyse comments and possibly make suggestions based on their own experience.

Other forms of data response questions can be cartoons, graphs, advertisements, and so on that learners are expected to engage with before answering a set of questions.

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Inclusive assessment

Teachers need to develop adaptive and alternative methods to assess learners with barriers to learning, so that learners are given opportunities to demonstrate competence in ways that suit their needs. Here are some examples of how to assess these learners, while still maintaining the validity of the assessment:

- Some learners may need concrete apparatus for a longer time than their peers.
- Assessment tasks, especially written tasks, may have to be broken up into smaller sections for learners who cannot concentrate or work for a long time, or short breaks may be given during the tasks. Learners can also be given extra time to complete tasks.

- Some learners may need to do their assessment tasks in a separate venue to limit distractions.
- A variety of assessment instruments should be used, as a learner may find that a particular assessment instrument does not allow them to show what they can do.
- Learners who cannot read can have tasks read to them and they can orally dictate answers. Assessment can also include a practical component in which learners can demonstrate their competence without having to use language.
- A sign-language interpreter can be used.
- Assessment tasks can be available in Braille or enlarged with bolded text.
- Assessment can include the use of dictaphones or computers with voice synthesisers.
- The forms of assessment used should be appropriate for age and developmental levels. The design of these tasks should cover the content of the subject and include a variety of tasks designed to achieve the objectives of the subject.

Recording and reporting assessment

Recording

Recording 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. Records of learner performance should be used to verify the progress made by teachers and learners in the teaching and learning process.

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Reporting

Learners' 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, and so on. Teachers in all grades report in percentages against the subject. The various achievement levels and their corresponding percentage bands are as shown in the table below.

Rating code	Description of competence	Marks %
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	20–29

NATURAL SCIENCE 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	

Teaching Natural Sciences in the Senior Phase

Grade 7 is usually the final year in primary school, though it is the beginning of the Senior Phase. The Grade 7 learners are the 'senior' learners in the school and as such they feel quite important. Learners must be challenged to think abstractly and critically, and not to merely copy information.

The transition to Grade 8 is an important one, and a big step. For many learners, for many different reasons, going to 'high school' is a combination of being exciting, yet challenging and even stressful. The writing of formal tests and examinations becomes even more important. The Natural Sciences teacher must spend time developing examination techniques which include unpacking terminology used in examinations, such as determine, identify, deduce, predict, present, summarise, expand, suggest, illustrate, and so on. The Learner's Book provides many built-in opportunities for learners to engage with these. Section 5 of the Teacher's Guide also provides a list of important terminology.

Presenting answers, time management, exam stress management, and so on are all important areas in which learners must receive constant coaching. Natural Sciences teachers should work very closely with Life Orientation teachers in order to support learners with these issues.

The volume of work increases in Grade 8, and the expectations are higher. Learners are also expected to mark their own work (from the board) and this is new to many Grade 8 learners.

Grade 9 is the most challenging grade in this phase. While being on the cusp of the final and another extremely important phase of their high school career, learners are also dealing with other issues important to them, such as sexuality. Girls develop faster than boys. Some schools separate the boys and girls in Grade 9 in order to address this issue.

Grade 9 is a crucial year in the teaching of Natural Sciences: learners are required to make a choice between content subjects in Grade 10. One of these subject choices will be Accounting. Learners will choose this subject based on their career aspirations, experience and level of success achieved in Natural Sciences in Grade 9. It is very important that teachers lay a good foundation for basic accounting skills in Grades 8 and 9 in order to facilitate suitable and appropriate subject choice.

Inclusive teaching

Review Copy

What is inclusive teaching?

In the Senior Phase, it is crucial that learners find themselves in an environment where they can develop an interest in learning and the belief that they can learn. Inclusive education is defined as a learning environment that promotes the full personal, academic and professional development of all learners irrespective of race, class, gender, disability, religion, culture, sexual preference, learning styles and language.

Inclusion is about acknowledging and respecting that:

- all children have the right to learn
- all children are able to learn
- all learners need support
- all learners are unique and have different, but equally valued, learning needs
- all learners need the opportunity to build on their own unique strengths
- the learner is the centre of the teaching and learning process
- there are differences in learners, for example, age, gender, language, culture, learning styles, disabilities, HIV status and so on.

Inclusion is also about:

- enabling educational structures, systems and learning methodologies to meet the needs of all learners
- more than just formal schooling – it embraces learning that occurs in the home, community and so on
- changing attitudes, behaviour, methodologies and environments to meet the needs of all learners
- ensuring maximum participation of all learners in the culture and curriculum of all educational institutions
- identifying and minimising barriers to learning that can occur at any level of the system.

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Some of the learners in your class may already suffer from exclusion or think negatively about education. There is no reason for their exclusion from class activities. It is the responsibility of the teacher to ensure the inclusion of these learners. This means adapting activities to suit their needs and capabilities. It is equally important that the class is not divided because of this. Rather, learners with these challenges should be accepted and helped where possible by their peers. Learners should at all times be discouraged from teasing, bullying or ignoring learners with special needs. When these attitudes are directed towards a learner, they create a barrier to learning in that learner.

Practical guidelines for inclusive teaching

- Have a true understanding of each learner's background, strengths, unique abilities, needs and barriers. Then use this information to inform your planning and give a clearer focus.

- Remember that the teacher is a facilitator of learning.
- Keep the content and material as relevant as possible.
- Break down learning into small, manageable and logical steps. Keep instructions clear and short (plan beforehand).
- Grade activities according to the different levels and abilities of learners. Try to ensure that learners remain challenged enough without undue stress.
- Develop a balance between individual teaching, peer tutoring, cooperative learning and whole-class teaching.
- Use learners to help one another in the form of group types, peer-assisted learning, buddy systems and so on. Ensure that learners feel included and supported in the classroom by both the teacher and their peers.
- Set up pairs and groups of learners where members can have different tasks according to strengths and abilities. Promote self-management skills and responsibility through group roles and the types of tasks you set.
- Motivate learners and affirm their efforts and individual progress. Build confidence. Encourage questioning, reasoning, experimentation with ideas and risking opinions.
- Determine the learner's 'Zone of Proximal Development' (ZPD) and use it for effective teaching and learning. The ZPD has been described as the distance between what the learner already knows and understands and what they can understand with adult support. Learning is thus a social interaction as the teacher mediates and supports the learner as they understand a new concept.
- Spend time on consolidating new learning. Use different ways to do this until all learners understand the concept. Make time to go back to tasks so that learners can learn from their own and others' experiences and methods.
- Use and develop effective language skills (expressive and receptive, verbal and non-verbal).
- Experiment with a variety of teaching methods and strategies to keep learners interested and to cater for and develop different learning styles. Use games, cooperative group work, brainstorming, problem-solving, debates, presentations and so on.

Review Copy

Learners with barriers to learning

A barrier to learning is anything that prevents a learner from participating fully and learning effectively. This includes learners who were formerly disadvantaged and excluded from education because of the historical, political, cultural and health challenges facing South Africans. Some other examples of barriers to learning may be learners who are visually or hearing impaired, or learners who are intellectually challenged. Barriers to learning cover a wide range of possibilities and learners may

often experience more than one barrier. Some barriers, therefore, require more than one adaptation in the classroom and varying types and levels of support.
These learners may require and should be granted more time for:

- completing tasks
- acquiring thinking skills (own strategies)
- assessment activities.

Teachers need to adapt the number of activities to be completed without interfering with the learners gaining the required language skills.

Metacognitive strategies in teaching

What are metacognitive strategies and how can I use them?
Metacognition is the process of thinking about how you think. Adults often do this automatically. Before taking on something new, we may ask ourselves:

- What do I already know about this?
- What will help me understand it better?
- How is it structured?

As we engage with a text or action, we may ask ourselves:

- Did I understand that?
- Why do I think that?
- How does this connect with what I already know?
- How could I apply this in my life?

Then we evaluate what we have learnt or done by asking questions like:

- Did I understand that well?
- What strategies helped and what strategies did not help?
- What should I do the next time I take on a task like this?

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Learners, however, are often unaware of how they think and engage with learning material. You help learners to learn independently by explicitly guiding them to plan, monitor, and evaluate their reading and learning strategies. This is particularly effective for those learning in English as a second language and for learners who are struggling. It can dramatically improve their performance.

You teach metacognitive skills by asking learners to explain what they are thinking and what strategies they are using to understand material. This is best done is small groups. You can also use 'think aloud' strategies when engaging with texts and images. 'Think alouds' are often effective when reading texts to learners, and during small-group and pair reading exercises.
Here is an example of how to teach metacognitive strategies using a 'think aloud':

1. Choose a short piece of text and note where you will stop during reading to model your thought processes.
2. Things to include in this planning stage could be:

- reading the text title and the table of contents
- looking at the images and predicting what the text may be about
- skim-reading the text looking for headings, words in bold, and summaries. As you skim read, think about what you already know about the subject and what more you would like to know.

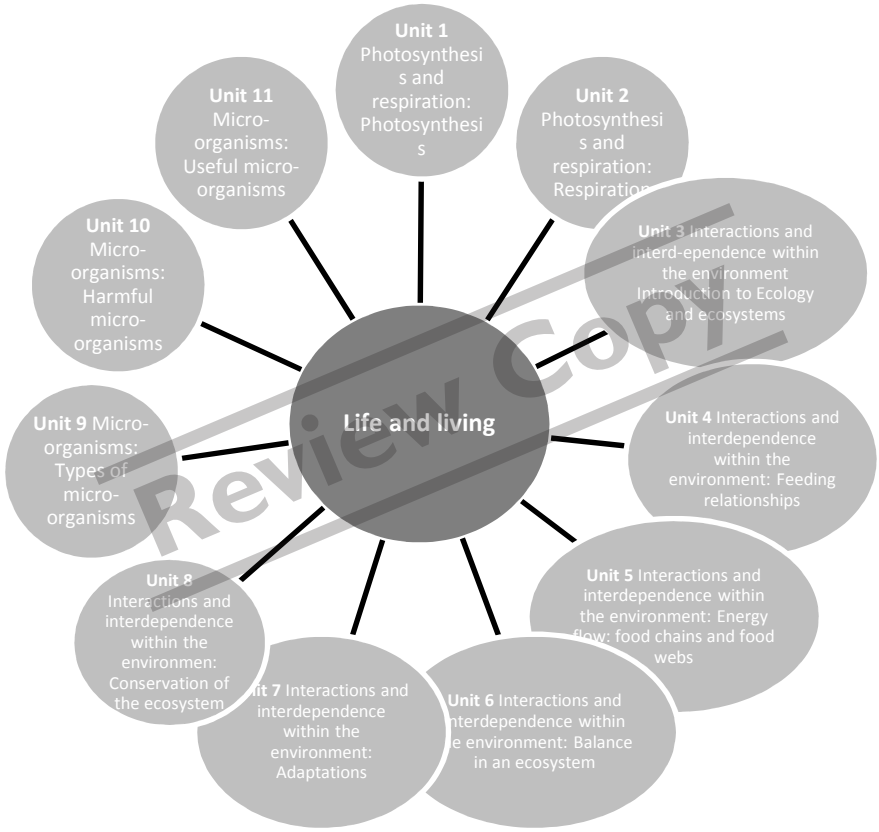
3. In class, explain what you will be doing to the learners. Start by explaining how you planned before reading the text.
4. To monitor understanding during reading, you can explain where you stopped to ask yourself whether you understood the content. If the text has a long or complex sentence, describe how you divided it up to understand it. Find places where you could ask questions such as:
   - Why would this …?
   - Is this similar to ... ?
   - How can I figure out what this new word means?
   - What does the writer want me to know?
   - What do I think will happen next? Why do I think that?
   - Do I need to re-read this for detailed information?
5. Now show learners how to evaluate their metacognitive strategies by asking and answering questions such as:
   - Did I read and understand this well?
   - What helped me to understand? What did not help?
   - What should I do next time I read about this topic?
   - What will help me remember what I read?

By engaging with how learners think, you can better prepare them for their lives and learning in the future. Consider how to include this aspect of learning into your teaching style.

Review Copy

Strand 1 Life and living

Core concepts covered



Review Copy

Strand overview

This strand introduces the learners to photosynthesis by discussing its requirements and looking at the products generated. The requirements and products of respiration are also explained. This is followed by and exploration of the interactions and interdependence within the environment. This includes an introduction to ecology, ecosystems and feeding relationships between all living organisms. This section continues with a look at the energy flow in food chains and food webs, balance in an ecosystem, adaptations of

organisms to the environment and conservation of the ecosystem. Learners are then introduced to micro-organisms. Various aspects including the different types and those that are harmful and useful are explored.

Content

Unit No.	Content	Pacing (Time allocation)	LB page	TG page
1	Photosynthesis and respiration: Photosynthesis	2 hours	12	30
2	Photosynthesis and respiration: Respiration	2 hours	16	32
3	Interactions and interdependence within the environment: Introduction to ecology	3 hours	20	34
4	Interactions and interdependence within the environment: Feeding relationships	2 hours	26	37
5	Interactions and interdependence within the environment: Energy flow: Food chains and food webs	2 hours	30	39
6	Interactions and interdependence within the environment: Balance in an ecosystem	1 hour	34	42
7	Interactions and interdependence within the environment: Adaptations	1 hour	38	44
8	Interactions and interdependence within the environment: Conservation of the ecosystem	1 hour	44	46
9	Micro-organisms: Types of micro-organisms	1hour	48	49
10	Micro-organisms: Harmful micro-organisms	1½ hours	52	51
11	Micro-organisms: Useful micro-organisms	1½ hours	56	53

Review Copy

Assessment

The following activities in this term are suitable for formal assessment:

Activity				Assessment	
Type of activity	**Activity**	**LB page**	**TG page**	**Assessment tool**	**TG page**
Practical task	Show that green leaves produce starch	15	31	Rubric	32
Practical task	Investigate the growth of yeast under different conditions	58	54	Rubric	55
Project	Find out more about a scientist's contribution to modern medicine	57	54	Rubric	54
Exemplar test	Strand 1 Exemplar test	61	–	Memorandum	142

Review Copy

Unit 1 Photosynthesis

Learner's Book pages 12–15

Unit overview

This unit introduces photosynthesis as a process that captures energy from the Sun and learners will explore the role of chlorophyll in photosynthesis.

Resources

Cardboard, scissors, leaves (freshly picked in the sunshine), heat source/spirit or Bunsen burner (or kettle), glass beaker, test tube, water, ethanol or methylated spirits (alcohol), iodine solution, dropper, white piece of cardboard, saucer or ceramic tile, forceps/tweezers

Teaching guidelines

- Introduce this unit by asking learners what would happen to plants if there was no Sun. Have a brainstorming session about the importance of plants in our world.

TIP! Have a poster on the classroom wall summarising the processes of photosynthesis: carbon-dioxide + water → glucose + oxygen

Review Copy

Background knowledge

All living things need energy to sustain life, and plants harvest this energy from the Sun in the form of heat and light using a process called photosynthesis.

Activity 1 **Write about requirements and products of photosynthesis** Learner's Book page 13

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to read through the instructions and explain anything they do not understand.

Background knowledge

It is important that learners know that chlorophyll is a very special and important substance which all plants need to be able to help them photosynthesise.

Suggested answers

Assessment guidelines

This activity is intended for informal assessment.
Write the above equation above on the board and ask learners to show their work to the class. Check that their chart is correct.

Remediation/Remedial activity

Summarise the process of photosynthesis on the board so that learners understand the basic process.

Practical activity 1	Show that green leaves produce starch (PoA) Learner's Book page 13

Review Copy

Guidelines to implement this activity

- This is a pair activity.
- Sort learners into pairs and ask them to read through the method of the experiment.
- Warn learners of the dangers of heating water and do not heat alcohol directly.
- Ask learners to write up their findings in a report form as described in the activity.

Background knowledge

Ethanol and methylated spirits have a lower boiling point than water so it is best to heat them in a beaker in a water bath. Chlorophyll obscures the iodine stain in a leaf and therefore has to be extracted from the leaf prior to staining it.
This activity is intended for formal assessment.
Use the marking rubric below to assess learners. Record the marks for formal assessment.

Criteria	Excellent	Good	Average	Needs help
Report has all six sections (headings) 6 marks	Has 6 sections (headings) 6 marks	Has 4 – 5 sections (headings) 4 – 5 marks	Has 2 –3 sections (headings) 2 – 3 marks	Has 1 section (heading) 1 mark
Report has all headings in the right order 6 marks	Has 6 headings in correct order 6 marks	Has 4 – 5 headings in correct order 4 – 5 marks	Has 2 – 3 headings in correct order 2 – 3 marks	Has 1 heading in correct order 1 mark
Report makes sense 8 marks	8 marks	Report makes sense 6 marks	Report makes sense 4 marks	2 marks
Total marks				**20 marks**

Remediation/Remedial activity

Go over the report write-up with the class.

Unit 2 Respiration

Learner's Book pages 16–19

Review Copy

Unit overview

This unit explains how food provides energy to plants and animals and how they obtain this energy by carrying out the process of respiration.

Teaching guidelines

- Ask learners to breathe in and then ask them how this helps their bodies.

Background knowledge

- Respiration is often confused with breathing. Make sure learners understand that respiration is the process of releasing energy from food and breathing is the inhalation and exhalation of oxygen. However, oxygen is required for respiration to occur.

Activity 1	Write about the requirements and products of respiration Learner's Book page 17

Guidelines to implement this activity

- This is an individual activity.
- Remind learners about how they carried out Activity 1 in Unit 1. Ask them to repeat the exercise for respiration and fill in the table for this activity.

Suggested answers

	Photosynthesis	Respiration
Requirements	Carbon dioxide,✓ water✓(2)	Glucose,✓ oxygen✓(2)
Products	Oxygen,✓ glucose✓(2)	Carbon dioxide,✓ water,✓ energy✓(3)

[9]

Total marks: 9

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Ask learners to swop books with a partner and mark each other's work. Ask them to allocate learners a mark out of 9.

Remediation/Remedial activity

Recap the reactions that occur in photosynthesis and respiration on the board.

Review Copy

Activity 2 Test for the presence of carbon dioxide in exhaled air

Learner's Book page 19

Guidelines to implement this activity

- This is an individual or pair activity.
- Read through the method of this experiment with learners and explain anything they do not understand.
- Ask them to write the answers to the questions in their workbooks.

Background knowledge

When carbon dioxide reacts with limewater it turns the limewater milky.

Suggested answers

The limewater turns milky.
That carbon dioxide was in the air that was breathed through the straw into the limewater.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Discuss the answers with the class and ask for a show of hands to determine the number of learners who answered correctly.

Unit 3 Ecology and ecosystems

Learner's Book pages 20–21

Unit overview

This unit describes what ecology is all about. Learners will read and learn what populations, communities, ecosystems and the biosphere are in the context of ecology. This unit also describes the biotic and abiotic components of an ecosystem. Learners will explore how to select and mark off and ecosystem in order to study it.

Resources

thermometer, hand lens, string and kebab sticks (for quadrats or transects), metre stick/tape measure, sieve, field guides, cellphones for photographs (optional)

Review Copy

TIP! Ask learners to help you draw up a diagram depicting the classroom ecosystem.

Teaching guidelines

- Take the class outside into the school grounds and ask them to identify organisms around them. Have a class discussion, and introduce the terms "habitat", "biosphere", "community".
- Ask learners to identify different ecosystems in their school grounds, parks, or gardens at home.

Activity 1 **Describe interactions** Learner's Book page 21

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Divide learners into groups and ask them look at and discuss the pictures in the Learner's book. Ask them to make notes about their discussion.

- After they have finished their discussions, get the class together again and discuss the results.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the checklist below to assess learners. Give learners feedback on their performance to prepare them for formal assessment.

Criteria The learner(s):	Yes	Partly	No
Discussed the pictures in adequate detail			
Described the interactions appropriately			
All took part in the group discussion			

Remediation/Remedial activity

Revise the meaning of population, community, ecosystem and biosphere on the board.

Extension/Extension activity

Give learners some other pictures of interactions and ask them to identify whether the interactions are at population, community, ecosystem or biosphere level.

Review Copy

Activity 2 Distinguish between populations and communities

Learner's Book page 21

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to complete the activity and then swap their workbooks with a partner for marking.

Suggested answers

1 Population, A✓, D✓ (2)
2 Community, C✓ (1)
3 Ecosystem, B✓ (1)
[4]

Total marks: 4

Assessment guidelines

- This activity is intended for informal assessment.

- Ask learners to mark each other's work and go through the answers on the board with them. Ask them to allocate a mark out of 4 to prepare them for formal assessment.

Remediation/Remedial activity

Ask learners to make up sentences using the terms "population" and "community" so they can learn the meaning.

Activity 3	List abiotic and biotic factors in an ecosystem Learner's Book page 23

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to study the figure for this activity and answer the questions in their workbooks.

Background knowledge

Biotic components of an ecosystem are those which are living and abiotic components are those which are not living, but influence the ecosystem.

1.1 Air, water, rocks (1)
1.2 Animals (buck), plants (1)
2 temperature ✓ rainfall ✓ (2)
3.1 Algae, seaweed (plants), animals (sea urchins, molluscs) ✓ (1)
3.2 Air, water (sea), rocks (1)
[6]

Total: 6 marks

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 6 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Go through the answers of the activity with the class.

Activity 4	Study an ecosystem	Learner's Book page 25

Guidelines to implement this activity

- This is a group activity (five learners per group).
- Divide the class into groups and ask them to choose an area they would like to study.
- Try and have a variation of areas across the class eg damp and shady, sunny, and so on.
- Ask learners to mark off a quadrat area in size and study the area, answering the questions to the activity in their workbooks.

Background knowledge

Ecosystems are affected by light and day as well, so it would be a good idea for learners to have a look at their ecosystems at a different time of day, or at least think about what it would be like.

Assessment guidelines

Use the rubric below to assess learners and allocate a mark out of nine. Give learners feedback on their performance to prepare them for formal assessment.

Criteria The learner(s):	Yes	Partly	No
followed the instructions in the Learner's Book and understood what to do.	3	2	0
Answered all the questions	3	2	0
Wrote up a report on their findings in summary form	3	2	0

Review Copy

Extension/Extension activity

Suggest to learners that they mark off a quadrant somewhere else and study the ecosystem, for comparison.

Unit 4 Feeding relationships

Learner's Book pages 26–30

Unit overview

In this unit, the role of plants, animals, and micro-organisms as producers, consumers and decomposers in ecosystems are investigated..

Teaching guidelines

- Show the learners some videoclips or pictures/photographs of animals hunting in a game reserve, or caterpillars eating leaves, and so forth.

- Ask them to name to identify the herbivore, omnivores, producers and consumers.

Background knowledge

The three groups involved in feeding relationships are producers, consumers and decomposers.

Activity 1	Classify organisms into their feeding groups Learner's Book page 29

Guidelines to implement this activity

- This is an individual activity.

Background knowledge

The three classes of organism feeding groups are carnivores (meat-eaters), omnivores (those that eat meat and plant matter) and herbivores (plant-eaters). Carnivores can be divided further into three groups: predators (animals that hunt animals), scavengers (those that eat animals which have been killed by another animal) and insectivores (those that eat insects).

Suggested answers

1 Buffalo,✓ warthogs,✓ elephants,✓ hyena,✓ wildebeest,✓ zebra,✓ kudu,✓ baboons,✓ guinea fowl,✓ ostrich,✓ snake,✓ tortoises,✓ vultures,✓ leopard,✓ cheetah,✓ fish✓ (16)

Review Copy

Herbivore	Carnivore: predator	Carnivore: scavenger	Carnivore: insectivore	Omnivore
buffalo✓ wildebeest✓ elephants✓ zebra✓ kudu✓ tortoise✓ warthog✓ ostrich✓	cheetah✓ leopard✓ snake✓	vulture✓ hyena✓	fish✓	baboons✓ guinea fowl✓

(16)

[32]

Total marks: 32

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 32 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Go over the answers in class and give learners some other examples of animals to classify.

Activity 2	Discuss careers in zoology, entomology and nature conservation Learner's Book page 29

Guidelines to implement this activity

- This is class or group activity.
- Ask learners to read through the paragraph on careers (forensic entomology) and discuss the answers to the questions in this activity.

Suggested answers

1 Zoology is the study of animals; entomology is the study of insects.
2 They keep the ecosystem free of dead animals by eating rotten flesh.
3 Helps conserve animals in the wild.
4 Help with animal poaching, help with solving other crimes.

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above and discuss the answers with the class.

Extension/Extension activity

Ask learners to go to the library and find our more information on entomology as a career.

Unit 5 Energy flow: food chains and food webs

Learner's Book pages 30–33

Unit overview

This unit describes how energy is passed on from one organism to the next in a food chain.

Teaching guidelines

- Have a brainstorming session in the class to find out what food chains are.
- Suggest that they too are part of a food chain to open up the discussion

TIP! Write a food chain on the board showing where learners are situated in the chain.

Background knowledge

A food chain always begins with the Sun and ends with decomposers. Each stage in a food chain is called a trophic level.

Activity 1	Draw and analyse energy pyramids	Learner's Book page 31

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to copy the energy pyramid scheme and answer the questions in their workbooks.

Review Copy

Suggested answers

1 & 3 The learner drew the food pyramids, put in the correct number of levels, and labelled each level of the pyramid. (4)

2 Each time energy is transferred from one trophic level to the next, some energy is lost. ✓ (1)

Total: 5 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Allocate learners a mark out of 5 and give them feedback on their performance to prepare them for formal assessment.

Activity 2	Write and draw food chains and food webs Learner's Book page 33

Guidelines to implement this activity

- This is an individual activity
- Ask learners to answer the questions to this activity in their workbooks.

Background knowledge

A food chain depicts the order of who eats what. A food web shows how food chains link together in an ecosystem.

Suggested answers

1.1plant✓→antelope✓→leopard✓ (1)
1.2plant✓→ grasshopper✓→bird✓ (3)
OR
plant✓→grasshopper✓→baboon✓ (3)
OR
plant✓→mouse✓→snake✓ (3)
1.3plant✓ mouse✓→snake✓→meerkat✓→eagle✓ (4)
2 plankton [insert arrow]crabs[insert arrow]crayfish [insert arrow]large fish [insert arrow] killer whales (2)
3 The learner included at least 2 food chains in their food web (2)

Total: 12 marks

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 12 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Give learners another food web to study and pick out different food chains

Activity 3	Identify a food chain or food web in a school ground's ecosystem Learner's Book page 33

Guidelines to implement this activity

- This is a pair activity.
- Read through the instructions to this activity with the class and then take them outside into the school grounds to select an area for observation.
- Spread pairs out so their chosen areas do not overlap.

- Ask them to make notes, sketches and take photographs to compile their food web or chain.

Assessment guidelines

Use the checklist below to assess learners. Give learners feedback on their performance to prepare them for formal assessment.

Criteria	Yes	Partly	No
The learner(s):			
Selected a specific area			
Collected appropriate data			
Put together a food chain/web successfully			

Remediation/Remedial activity

Ask learners to show their food webs/chains to the other members of the class and discuss them.

Unit 6 Balance in an ecosystem

Learner's Book pages 34–37

Review Copy

Unit overview

This unit looks at factors which can disturb the balance in an ecosystem.

Teaching guidelines

- Ask learners to give examples of ecosystems they can think of which have become unbalanced. Discuss what happened to them and list the factors which caused the imbalance.
- Give them a clue by suggesting coal mining, or building developments.

TIP! Write keywords on the board highlighting factors which disrupt the balance of an ecosystem.

Background knowledge

Examples of disrupting factors pollution are floods, drought, fires, poaching,.

Activity 1 **Evaluate the impact of various factors on ecosystems**

Learner's Book page 35

Guidelines to implement this activity

- This is a group activity
- Divide learners into groups and to discuss how the listed factors have an impact on ecosystems.

Suggested answers

Loss of habitat – Animals die or move away to another place and others move in, animals and plants may become extinct
Loss of species – Other species are introduced as there competition has been eradicated
Change of weather or climate – animals cannot tolerate the change so move to another area, or those that survive have adaptations for survival

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally during a class discussion.

Activity 2	**Evaluate the impact on a food web when one of the organisms is removed** Learner's Book page 37

Guidelines to implement this activity

- This is an individual activity
- Read the two case studies through with the learners and ask them to answer the questions in the activity.

Review Copy

Suggested answers

2.1The wildebeest of the Serengeti and the rinderpest epidemic ✓ (1)
2.2The hunting of the California sea otter ✓ (1)
3.1 wildebeest, (1),
California sea otter (1)
3.2 The learners recognised that when the keystone species was removed, the entire ecosystem was disrupted (1)
[5]

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 5 and give them feedback on their performance to prepare them for formal assessment.

Extension/Extension activity

Ask learners to find recent newspaper articles which report on examples of food chain/food web disruptions.

Unit 7 Adaptations

Learner's Book pages 38–43

Unit overview

This unit looks at the ways in which organisms are suited to their environment. Some adaptation features are investigated, as well as adaptation as a slow process of change.

Resources

Potted cactus or aloe

Teaching guidelines

- Show learners a potted cactus or aloe and discuss why the plant has spines or prickles.

Review Copy

Activity 1 Draw and describe how some plants are adapted to their environment

Learner's Book page 39

Guidelines to implement this activity

- This is an individual activity

Suggested answers

1 & 2 Aloe – thorns to prevent animals from eating them,✓ thick, fleshy[insert tick please]
leaves to store water in dry conditions (2)
Sundew – sticky fluid✓ and fine hairs✓ to catch insects (2)
Pitcher plant – deep flower so that insect cannot escape while being digested✓ (2)

3 Mangrove trees extensive, far-reaching roots function as an adaption to give them support in soft soils (the roots also have adaptions to prevent or limit the intake of salt water) (2)Prickly pears have thick fleshy leaves to store water in arid conditions, they have spines to prevent animals from eating them. (2)

Total: 8 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Ask learners to swop their books and mark each other's work using the suggested memorandum above to assess learners informally, allocating each other a mark out of eight..

Extension/Extension activity

Ask learners to look up other plants or even bring some plant samples from home which have specific adaptations for survival in their environment.

Activity 2	Describe adaptations in animals	Learner's Book page 42

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to read the case studies and answer the questions in their workbooks.

Background knowledge

Animals have adaptations for living in extreme environments and for being a predator among other things.

Suggested answers

1.1 Camel has wide feet to spread the load on the desert sand,✓ polar bear has large paws to spread its load on ice and snow✓ (2)

They both have small ears✓✓ (2)

1.2 Long eyelashes✓ and hair-lined nostrils✓ that can close to keep sand out of eyes and nose (2)

1.3 Great white shark: it can detect the movement of animals in the water as an electromagnetic field,✓ has a very powerful tail and can swim so fast when it attacks that it sometimes shoots out of the water,✓ pointed snout and smooth body make it very streamlined and fast,✓ two rows of triangular teeth, with new ones ready to grow into place when it needs them,✓ top half of its body is grey-blue to match the colour of the water✓ (5)

OR

Cheetah: long legs and narrow, lightweight body for acceleration and manoeuvrability,✓ good binocular vision,✓ larger than usual nostrils, lungs and heart for quick breathing,✓ long muscular tail as a counterweight for balance, and a rudder,✓ hard, ridged paw pads for and claws that cannot retract completely for good grip or traction✓ (5)

Review Copy

2 Camouflage - colours and patterns similar to its natural environment to blend in and therefore hide it from predators.. Mimicry is when one harmless species evolves to look like a dangerous one. (3)

3 Stick insect – colour and elongated shape of body and legs is the same as sticks/wood so that it blends into the tree branches, protecting it from predation, Sea urchin as sharp spines to protect it from predation .(3)

[11]

Total: 11 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 11 and give them feedback on their performance to prepare them for formal assessment.

Unit 8 Conservation of the ecosystem

Learner's Book pages 44–47

Review Copy

Unit overview

This unit introduces the principles of conservation to learners. They learn about the ways environmentalists and nature conservationists manage and protect ecosystems, as well as how they as individuals can contribute to conservation.

Teaching guidelines

- Introduce this unit by asking learners what they understand by the term "biodiversity".
- Write keywords up on the board.

TIP! Ask learners whether they can list different kinds of animals and plants which make up the biodiversity of the region surrounding where they live.

Background knowledge

Biodiversity refers to the vast range of organisms that exist in the ecosystems. Some areas have greater biodiversity than others. It is important to conserve ecosystems so that the extent of their biodiversity remains.

Activity 1	Write about the importance of biodiversity and sustainable use of resources Learner's Book page 44

Guidelines to implement this activity

- This is a pair activity.
- Divide the class into pairs and ask them to write down the answers to the questions in this activity in their workbooks.

Suggested answers

1 Biodiversity describes all the different living organisms on this earth.
2 Important because otherwise ecosystems will become unbalanced and this will affect the biodiversity.
3 Thing will run out – some living organisms will become extinct.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the checklist below to assess learners, allocating them marks out of nine.. Give learners feedback on their performance to prepare them for formal assessment.

Review Copy

Criteria The learner(s):	Yes	Partly	No
Gave the correct definition for biodiversity	3	2	0
Explained adequately why it is important to maintain biodiversity	3	2	0
Gave the correct answer for what happens if resources are not used in a sustainable way.	3	2	0

Activity 2	Discuss careers in nature conservation and environmental studies Learner's Book page 45

Guidelines to implement this activity

- This is a group (six learners per group) or class activity.
- Divide the class into groups and ask them to read the careers feature.
- Then take them to the library to look up information so they can answer the questions in this activity.

Suggested answers

2 tourism to areas which support nature and nature conservation
3 mathematics, biology, physical science

4 They must have an interest in animals, birds, plants, nature in general. They are passionate, dedicated, hardworking, need to work unusual hours, not interested in making large amounts of money, enjoy telling people about their job, must enjoy working in a team.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally.

Activity 3	**Write about the impact of irresponsible human practices on ecosystems** Learner's Book page 47

Guidelines to implement this activity

- This is a group activity.
- Ask learners to study to two pictures on page 47 and discuss in their groups different ways in which people act irresponsibly towards the environment.
- Ask them write their answers down in their workbooks.

Background knowledge

Learners need to know that they must save water, reduce energy consumptions, dispose of waste responsibly, and think about the cost to the environment before buying things.

Review Copy

Suggested answers

2 Littering,✓ wasting water (resources) by watering gardens in the heat of the day, leaving taps on ✓ not recycling,✓ wasting electricity by, for example, leaving appliance on standby and leaving lights on all day,✓ driving short distances instead of walking,✓ using new plastic shopping bags instead of re-using bags ✓ (any 5)

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Allocate learners a mark out of 5 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Go through the lists that learners have compiled in the class.

Unit 9 Types of micro-organisms

Learner's Book pages 48–51

Unit overview

In this unit, learners will find out about the smallest living things called micro-organisms. They will learn that these can only be seen under magnification and they will be introduced to some micro-organisms such as viruses, bacteria, protists and fungi.

Resources

Hand lenses/magnifying glasses or micro viewers, bread mould, newsprint. micrographs of micro-organisms with scale bars.

Teaching guidelines

- Begin this unit by asking learners whether they know what causes humans to suffer from flu, or whether they know where antibiotics used to treat certain illnesses come from?

Background knowledge

The four groups of micro-organisms covered in this unit are bacteria, protists (unicellular algae belong to this group), viruses and fungi.

Review Copy

Activity 1	Use hand lenses to examine bread mould and newsprint Learner's Book page 50

Guidelines to implement this activity

- This is a pair activity.
- A few days in advance of carrying out this activity, take some bread slices and generate some bread mould.

Background knowledge

Bread mould thrives in warm, humid conditions. To encourage bread mould growth for this activity, dampen some bread slices, put them in a plastic bag, and leave the bag in a warm place. Mould should start forming in a few days.

Assessment guidelines

- This activity is intended for informal assessment.
- Go through the instructions of this activity with the class and ask them what they observe.

Activity 2	Examine and analyse photographs of micro-organisms Learner's Book page 51

Guidelines to implement this activity

- This is an individual activity
- Before learners begin this activity, take a different micrograph and demonstrate how you would go about using the scale to calculate the real size of the organism – you can use the worked example to aid in your demonstration.
- Ask learners to write down each measurement as shown in the Learner's Book Figure 8 from steps 1 to 4.

Suggested answers

Length of paramecium in (mm) ✓ (1)
Length of line that represents one micrometre (mm) ✓ (1)
Paramecium length divided by length of scale = factor✓ (1)
Multiply scale length by this factor = micrometre size = real size of the paramecium. ✓ (1)

Total marks: [4]

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Write the suggested answer protocol on the board and ask learners to swop their workbooks with a partner to mark them and allocate learners a mark out of 4.

Remediation/Remedial activity

Give learners a different micrograph with a different organism so they can practice calculating its real size.

Unit 10 Harmful micro-organisms

Learner's Book pages 52–55

Unit overview

In this unit, learners find out how micro-organisms cause disease. They will learn how diseases are spread and about some ways of preventing their spread. They also explore the role of scientists in developing cures for some of the diseases.

Teaching guidelines

- Ask learners to brainstorm examples of harmful micro-organisms.

TIP!	Mention some well know diseases such as HIV, diarrhoea and TB and ask learners if they know what causes these.

Background knowledge

Malaria is caused by a protest parasite and spread by mosquitoes. HIV is caused by a virus, TB is caused by bacteria that infect the lung and most diarrhoea in young children is caused by a virus.

Activity 1	**Write about one disease caused by a micro-organism** Learner's Book page 53

Guidelines to implement this activity

- This is an individual activity.
- Take learners to the library and ask them to research a disease caused by a micro-organism on the internet and/or in books.
- Check that the disease each learner is going to write about is in fact caused by a micro-organism and not something else.

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the checklist below to assess learners. Give learners feedback on their performance to prepare them for formal assessment.

Criteria The learner(s):	Yes	Partly	No
Selected a disease caused by a micro-organisms			
Included the cause, effects, symptoms and treatments of the disease			
Wrote in a logical manner			

Remediation/Remedial activity

Share the different diseases that each learner chose to write about and ask learners to briefly summarise the outcome of their research.

Activity 2	**Discuss beliefs about disease caused by micro-organisms** Learner's Book page 55

Guidelines to implement this activity

- This is a class activity.
- Ask a learner to read the case study out to the class and have a discussion on the cultural and historical beliefs about diseases caused by micro-organisms. Encourage all learners to participate in the discussion.

Assessment guidelines

- This activity is intended for informal assessment.
- Encourage all learners to participate in the class discussion.

Activity 3	**Find out more**	Learner's Book page 55

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to read through the passage in the Learner's Book.
- Take them to the library and ask them to look up information about pasteurisation, anthrax, rabies, vaccination or scientists who have developed cures for diseases.
- Ask them to make notes and have a class discussion on the outcome of their research. Ask each learner to contribute to the discussion.

Review Copy

Background knowledge

Pasteurisation of fresh milk involves heating to about 60 °C for 15 to 20 seconds. Anthrax is caused by the bacterium *Bacillus anthracis*. It is a lethal disease which is spread by spores, affecting humans and animals. The spores are very stable, which is why they could potentially be used as a biological weapon. There is a vaccine available against anthrax. Rabies is caused by a virus and can spread from animals to humans. It causes disease in the brain and subsequent death, but there is a vaccine available to protect animals and humans against it.

Assessment guidelines

- This activity is intended for informal assessment.

Criteria	Yes	Partly	No
The learner(s):			
Researched at least one aspect for this activity			
Contributed some information to the class discussion			

Extension/Extension activity

Ask learners to go to the library and read up more on these topics.

Unit 11 Useful micro-organisms

Learner's Book pages 56–59

Unit overview

In this unit, learners find out about the essential role that some micro-organisms play as decomposers in ecosystem, and the role of micro-organisms in food and medicine.

Resources

Instant dried yeast, sugar, kettle, water, thermometer, teaspoon or spatula, beakers or cups.

Teaching guidelines

- Introduce this topic by asking whether any of the learners like yoghurt and if so, do they know how it is made.

TIP!	Make a list of useful micro-organisms on the board.

Activity 1	**Find out more about a scientist's contribution to modern medicine** **[PoA]** Learner's Book page 57

Review Copy

Guidelines to implement this activity

Working with the material provided in the case study on Learner's book page 57, sketch out a worked example of a poster on the board with the class. Use the case study to guide the learners. Learners should use the library and the internet if available to carry out their research.

Background knowledge

Micro-organisms are of enormous value to us in the fields of medicine and food, as well in the natural environment. It is through the work of scientists that we have come to benefit from and understand some of the beneficial uses of micro-organisms,

Assessment guidelines

Assess the posters according to presentation and content as detailed in the rubric provided below:

The information is well put together, relevant, interesting and concise	10

The presentation makes the poster easy to read and attractive	10

Total marks: 20

[20]

Practical Activity 2	Discuss careers that require knowledge of micro-organisms (PoA) Learner's Book page 58

Guidelines to implement this activity

- This is a pair activity.
- Divide the class into pairs and read through the method of the experiment with the class so they understand what to do.
- Ask them to make notes so they can write up a report on the experiment using the seven different headings indicated – refer them to the worked example on page 14 to help them.
- This activity is intended for formal assessment.
- Use the marking rubric below to assess learners . Record the marks out of 20 for formal assessment.

Your report …	Marks
has all seven sections (headings)	7
has all the headings in the right order	3
describes meaningful results	10

[20]

Review Copy

Activity 2	Discuss careers that require knowledge of micro-organisms Learner's Book page 59

Guidelines to implement this activity

- This is an individual activity.
- Ask a learner to read the case study to the class and have a discussion on this.
- Talk about the role of the micro-organisms in each of the pictures in the activity and then match the careers to the pictures.

Background knowledge

There are numerous careers that require knowledge of micro-organisms. These include scientists, specialist doctors, forensic scientists, brewers, veterinarians.

Assessment guidelines

- This activity is intended for informal assessment.

- Use the suggested answers supplied above to assess learners informally. Ask learners to mark their own work and allocate themselves a mark out of 15.

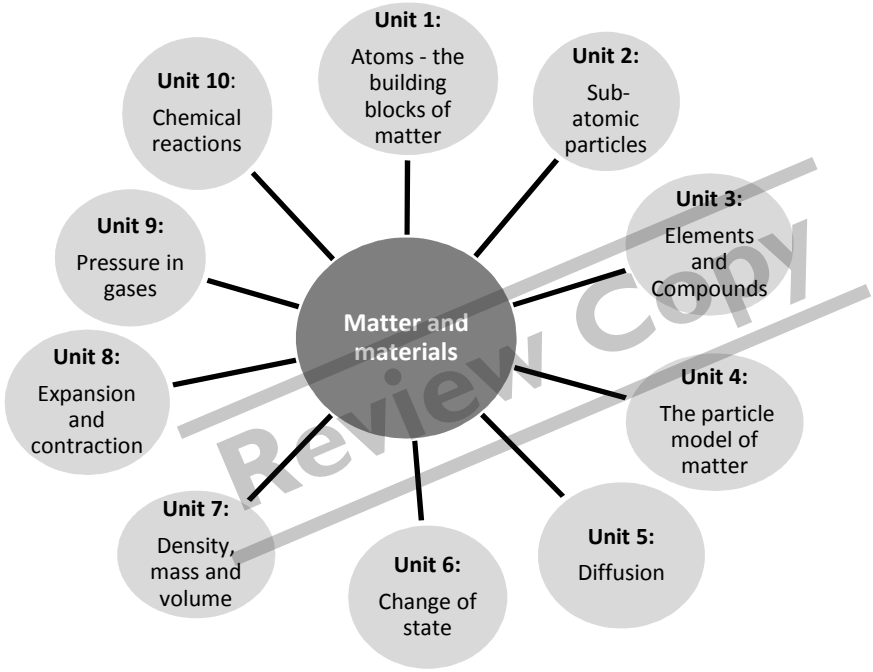
Extension/Extension activity

Ask learners to research careers that people who study fungi, yeasts, or viruses, can take up.

Review Copy

Strand 2 Matter and materials

Core concepts covered



Review Copy

Strand overview

In this strand learners are introduced to atoms, which are the building blocks of matter. They look at sub-atomic particles, pure substances, different compounds and mixtures of elements and compounds. They learn about the particle model of matter, which includes looking at particles in solid, liquid and gas forms. The changes of state of particles, and their density, mass and volume are discussed, as well as the density and state of matter in general. The density of different materials is explored as well as expansion and contraction of materials and pressure. The strand ends with a short section on chemical reactions, discussing reactants and products.

Content

Unit No.	Content	Pacing (Time allocation)	LB page	TG page
1	Atoms – the building blocks of matter	1 hour		59
2	Atoms: Sub-atomic particles	1 hour		59
3	Atoms: Elements and compounds	2 hours		61
4	Particle model of matter: The concept of the particle model of matter	1 hour		64
5	Particle model of matter: Diffusion	½ hour		66
6	Particle model of matter: Change of state	1 hour		68
7	Particle model of matter: Density, mass and volume	1 hour		69
8	Particle model of matter: Expansion and contraction	1 hour		73
9	Particle model of matter: Pressure in gases	½ hour		74
10	Chemical reactions: Reactants and products	1½ hours		76
				78

Review Copy

Assessment

The following activities in this term are suitable for formal assessment:

Activity				Assessment	
Type of activity	Activity	LB page	TG page	Assessment tool	TG page
Practical task	Compare and calculate the density of different materials	84	71	Memorandum	71
Exemplar	Exemplar test: Term 2	98	80	Memorandum	80
Exam	Exemplar exam: Terms 1 and 2	100	81	Memorandum	81

Unit 1 Atoms – the building blocks of matter

Learner's Book pages 64–66

Unit overview

This unit explores the atom, the building block of matter.

Resources

Examples of pure elements such as copper (wire), silver (jewellery)

Teaching guidelines

- Ask learners how big they think an atom is.

TIP! Ask learners to look at a 1 mm distance on their ruler and imagine 10 million atoms lined up along this millimetre distance.

Background knowledge

The biggest difficulty is imagining the size of an atom as it cannot be seen with the naked eye. Most of what is known about atoms and their structure is derived from work carried out by physical scientists and physical chemists.

Review Copy

Unit 2 Sub-atomic particles

Learner's Book pages 66–67

Unit overview

In this unit, learners learn about the sub-atomic particles: protons, neutron, and electrons.

Resources

Dried lentils, dried peas, died barley, paper plates, glue, koki pens
Chart/diagram of an atomic structures showing protons, neutrons and electrons.

Teaching guidelines

- Show learners a video clip of what atoms look like, and how they are structured.

Background knowledge

"Sub" in the term "sub-atomic" particles refers to particles that are even smaller than atoms.

Activity 1	Make a model of an atom	Learner's Book page 67

Guidelines to implement this activity

- This is a group activity (five learners per group). Each member of a group must make a model of an atom.
- Assign an element (up to the 20th element) to each person in each group. Make sure that each person in one group makes an atom of a different element. If there are more than 20 learners, assign atoms from the first element again.
- Read through the steps in the activity with the class and then show learners a model that you have already made, so they know where to stick the protons, neutrons and electrons.

Background knowledge

You can stick the neutrons (peas) and protons (lentils) close to each other in the middle of the plate to represent the nucleus. Leave a small gap around the nucleus before sticking the electrons (barley) down.

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the checklist below to assess learners and allocate a mark out of nine. Give learners feedback on their performance to prepare them for formal assessment.

Criteria The learner(s):	Yes	Partly	No
followed the instructions in the Learner's Book and understood what to do.	3	2	0
Stuck the neutrons and protons in the correct place	3	2	0
Stuck the electrons in the appropriate rings around the nucleus		2	0
Labelled their atom correctly	3	2	0

Remediation/Remedial activity

Ask learners to hold up their atoms and explain it.

Extension/Extension activity

Ask learners to make another atom of a different element if they have time.

Unit 3 Elements and compounds

Learner's Book pages 68–73

Unit overview

This unit explores the difference between elements and compounds. It also defines molecules and looks at breaking down of compounds with heat or electricity.

Resources

modelling clay or play-dough (at least two different colours), potassium permanganate, heat source/Bunsen burner/spirit lamp, ceramic dish/test tube (heat resistant), wooden splint, matches, copper chloride solution, cell/battery, metal plates (electrodes), conducting wires, test tubes or small glass bottles

Teaching guidelines

- Revise with the class what an element is.
- Refer to the periodic table when you do this.
- Suggest to the learners that everything in this world is made up of different combinations of elements.

Review Copy

TIP! Have a poster on the wall in the classroom which shows the difference between elements and compounds.

Activity 1 Make models of molecules

Learner's Book page 69

Guidelines to implement this activity

- This is a pair activity.
- Ask each learner of a pair to make three molecules.
- Demonstrate to the class how to make one molecule.

Assessment guidelines

- This activity is intended for informal assessment.
- Ask learners to line their models up in the front of the class and compare the corresponding models.
- Ask them to check that all models representing the same molecule are correct, and to point out mistakes.

Remediation/Remedial activity

Line up 6 models of correctly made O2, H2, N2, H2O, CO2 and revise the structures.

Activity 2	Classify molecules as elements or compounds Learner's Book page 71

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to read through the questions in this activity and answer them in their workbooks.

Background knowledge

Elements are substances made from only one kind of atom. Compounds are substances made from atoms of two or more different elements.

Suggested answers

1. element
2. compound
3. compound
4. element
5. element

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Ask them to swop their books with a partner and give them a mark out of five. Assess their performance by asking for a show of hands who got full marks.

Remediation/Remedial activity

Revise the definition of element and compound and give learners more examples to complete.

Activity 3	Demonstrate how a compound can be broken down (into elements) by heating Learner's Book page 72

Guidelines to implement this activity

- This is a class activity. The teacher should demonstrate this experiment.
- Set up the apparatus for the experiment and ask the class to group around you to watch. As the glowing splint relights, ask learners why this happens.

Background knowledge

A glowing splint is used to test for the presence of oxygen gas. It relights in oxygen gas. The heating of of potassium permanganate produces oxygen and potassium manganate and manganese dioxide: $KMnO_4 \xrightarrow{\Delta} K_2MnO_4 + MnO_2 + O_2$

Suggested answers

Oxygen is released when potassium permanganate is heated, which makes the wooden splint burn.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally.

Activity 4	**Demonstrate how a compound can be broken down into elements by electrolysis** Learner's Book page xx

Guidelines to implement this activity

- This is a class activity. The teacher should demonstrate this experiment.
- Follow the guidelines in Figure 12 in this activity to set it up.
- Ask learners to record what happens in their workbooks.

Review Copy

Background knowledge

Use carbon electrodes and a power source of about three to nine volts.

Suggested answers

1. chlorine gas,✓ element✓ (2)
2. copper,✓ element✓ (2)

Total: 4 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Ask them to mark their own work as you go through the answers with them.

Unit 4 The particle model of matter

Learner's Book pages 74–75

Unit overview

This unit details the difference between solids, liquids and gases in terms of their particle arrangement.

Resources

Frozen peas, split peas or marbles; lid of coffee jar.

Teaching guidelines

- Show learners a piece of glass or a piece of wood, and some water and ask them what they think they would see if the glass, wood or water was magnified many times.
- Then revise the concept of an atom and have a class discussion as to what makes wood look different from glass.

TIP!	Emphasise to learners that all matter is made up of particles that behave in specific ways which determine whether the matter is in a liquid, gas or solid form.

Background knowledge

The particle model is a way of looking at solids, liquids and gases to understand the way they behave.

Review Copy

Activity 1	**Make a particle model of solids, liquids and gases** Learner's Book page 74

Guidelines to implement this activity

- This is a pair activity.
- Ask learners to read through the instructions before carrying out this activity.
- Ask learners to write down their observations for a gas, liquid and solid.

Assessment guidelines

- This activity is intended for informal assessment.
- Assess learners by verbally asking for the observations they made.

Remediation/Remedial activity

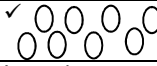
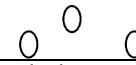
Have a class discussion on the results of the activity so that learners understand the differences between a solid, liquid and gas using the particle model of matter. Make diagrams on the board to assist those that are having difficulty.

Activity 2	Compare the particles of solids, liquid and gases Learner's Book page 75

Guidelines to implement this activity

- This is an individual activity. Ask learners to copy the table in Activity 2 into their workbooks and complete it.

Suggested answers

	Solid	Liquid	Gas
Drawing	✓	✓ 	✓ 
Arrangement of particles	Packed closely together in a regular arrangement✓	Loosely arranged but still quite close together✓	No particular arrangement and are far apart✓
Spacing between particles	Small✓	small✓	Large✓
Forces of attractions between particles/How strongly particles pull together	strong✓	weaker✓	Very weak✓
Movement of particles – speed and direction	Do not move around but vibrate against each other✓	Move quite fast and slide past each other✓	Move very fast✓

Total: 15 marks

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 15 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Go over the table with learners on the board.

Project

- The mass of a R5 coin is 9g.
- The volume of a R5 coin is about 1 ml, which is 1 cm3 (Because it is difficult to see a volume change of 1 ml, measure the volume of ten coins and divide by ten)
- The density of a R5 coin is 9g ÷ 1cm3 = 9g/cm3

Assign marks as follows:

	Yes	Partly	No
Mass of coin correct	10	5	0
Volume of coin correct	10	5	0
Density of coin correct	10	5	0

Total marks: 30

Unit 5 Diffusion

Learner's Book pages 76–77

Unit overview

This unit describes how particles of a liquid or a gas move around.

Resources

potassium permanganate/food colouring and dropper, glass beaker/jar, water, ether and cotton wool or a can of deodorant

Teaching guidelines

- Have a class discussion about what happens when smoke is emitted from someone's cigarette: what happens to it, where does it go?

Background knowledge

Diffusion is the process in which particles in liquids or gases separate and spread out.

Review Copy

Practical Investigation 1 Investigate diffusion in a liquid

Learner's Book page 76

Guidelines to implement this activity

- This is a group or class activity (5 learners per group).
- Read over the instructions to this activity with the class and ask them to write the answers to the questions in their workbooks.

Background knowledge

Potassium permanganate will take a few days for the purple colouring to be equally distributed.

Suggested answers

1 Observed number of days✓ (1)

2 diffusion ✓ (1)
3 faster✓ (1)

Total: 3 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the answers supplied above to assess learners. Allocate learners a mark out of four.

Extension/Extension activity

Ask learners to test diffusion of other liquids, making sure they are coloured differently so that they can distinguish between the water and the test liquid.

Practical investigation 2 Investigate diffusion in a gas

Learner's Book page 77

Review Copy

Guidelines to implement this activity

- This is a class activity.
- Ask learners to close all the windows and doors to the classroom.
- Read through the activity with the class so that they know they need to raise their hand as soon as they smell the deodorant or ether.
- Ask someone to time from when you release the smell to when the person at the back of the classroom smells it.

Suggested answers

1 Observed time
2 The particles of a gas move faster than particles of a liquid.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above. Discuss the answers to this activity verbally with the class.

Extension/Extension activity

Test the rate of diffusion after an orange has been peeled.

Unit 6 Change of state

Learner's Book pages 78–79

Unit overview

In this unit learners will investigate why matter sometimes changes its state if it is heated or cooled.

Resources

Candle wax, tin can/foil pie dish, spirit burner/Bunsen burner, tripod stand, gauze wire mat, matches, thermometer.

Teaching guidelines

- Introduce this unit by asking learners what happens when cheese is melted, or when water is put into the freezer.

Background knowledge

The extent of movement of the particles in matter determines whether it is a liquid, solid, or gas.

Review Copy

Practical investigation 1 Investigate the change of state in candle wax

Learner's Book page 79

Guidelines to implement this activity

- This is a group activity.
- Warn learners of the dangers of working with hot wax.
- Read through the activity with the class before asking them to proceed.
- Ask them to record their results in their workbooks.

Background knowledge

The hot, liquid wax will solidify if the heat source is removed and the melted candle is allowed to cool down. Do not heat the wax to very high temperatures in order to vaporise it as the vapour can ignite.

Suggested answers

1 Learners measured temperature. ✓ (1)
2 Learners measured temperature. ✓ (1)

2.1 When temperature decreases the particles move more slowly✓ and eventually become fixed in position resulting in a solid. ✓ (2)

Assessment guidelines

- This activity is intended for informal assessment.
- Use the checklist below to assess learners allocating marks out of 12. Give learners feedback on their performance to prepare them for formal assessment.

Criteria The learner(s):	Yes	Partly	No
followed the instructions in the Learner's Book and understood what to do.	3	2	0
measured and recorded the melting temperature accurately	3	2	0
measured the recorded the solidifying temperature accurately	3	2	0
gave the correct explanation for why molten wax changes into a solid when it cools.	3	2	0

Review Copy

Unit 7 Density, mass and volume

Learner's Book pages 80–85

Unit overview

This unit introduces the relationship between the properties of density, mass and volume.

Resources

measuring cylinder, water, stone, materials like polystyrene, sponge, wood, metal, putty, bread, ruler, knife, beaker/glass jar and lid, oil, water, mass balance, kitchen scale paper cups, sand, flour, water

Teaching guidelines

- Ask learners what happens to the level of water in the bath when they sit in it.

TIP! Write up the definitions of mass, volume and density on the board so learners can refer to them.

Background knowledge

The mass of an object is the amount of matter it contains. The volume of an object is the amount of space it takes. The density of an object is the amount of mass in a particular volume.

Activity 1	Measure the volume of a stone	Learner's Book page 81

Guidelines to implement this activity

- This is a pair activity
- Check that learners are able to read the scale on the side of the measuring cylinder
- Ask learners to record their results in their workbooks.

Suggested answers

1. measured volume of water: x ml√ (1)
2 measured volume of water with stone: y ml√ (1)
3 calculation: x ml√-y ml√ = z ml√ (3)

[5]

Total: 5 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Allocate learners a mark out of 5.

Review Copy

Remediation/Remedial activity

Give learners a different size of stone and ask them to repeat the exercise.

Activity 2	Find and compare materials with the same volume but different mass	Learner's Book page 83

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Help learners who are struggling to cut blocks, particularly if you use polystyrene.
- If you have the means for weighing the blocks, ask learners to record the weights of the different blocks.

Background knowledge

It is important to check that all the blocks that are cut are of the same size.

Suggested answers

1 wood/metal✓ (1)
2 density✓ (1)
3.113 ✓ (1)
3.282 ✓(1)
3.3the particles of lead have a greater mass than the particles of aluminium✓ (1)
[5]

Total: 5 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Ask learners to check their answers and give themselves a mark out of five.

Activity 3	**Compare the densities of different materials [PoA]**

Learner's Book page

Review Copy

Guidelines to implement this activity

- This is a group activity (five learners per group).
- Ask learners to write the answers to this activity in their workbooks.

Suggested answers

1 Oil is less dense than water
2.1 A liquid oil spill which spreads over the surface of the sea, forming a thin film or layer.
2.2 Because they can float and move anywhere in the sea.

- This activity is intended for informal assessment.
- Use the checklist below to assess learners. Give learners feedback on their performance to prepare them for formal assessment.

Criteria The learner(s):	Yes	Partly	No
Followed the instructions in the activity			
Were able to explain why oil floats			
Answered the case study questions correctly			

Extension/Extension activity

Ask learners to test what happens if they pour melted butter/margarine on to water.

Activity 4	Compare the densities of oil and water Learner's Book page 85

Guidelines to implement this activity

- This is a group activity (five learners per group).
- First, learners must read the case study on oil pollution on page 85 of the Learner's Book.
- Ask learners to write the answers to this activity in their workbooks.

Suggested answers

Case study:

1 Oil is less dense than water.

2 A liquid oil spill which spreads over the surface of the sea, forming a thin film. or layer.

Activity 4:

1 Oil is less dense than water.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the checklist below to assess learners, allocating a mark out of nine. Give learners feedback on their performance to prepare them for formal assessment.

Criteria The learner(s):	Yes	Partly	No
Followed the instructions in the activity	3	2	0
Were able to explain why oil floats	3	2	0
Answered the case study questions correctly	3	2	0

Review Copy

Extension/Extension activity

Ask learners to test what happens if they pour melted butter/margarine on to water.

Unit 8 Expansion and contraction

Learner's Book pages 86–87

Unit overview

This unit teaches learners how matter swells when heated, or shrinks when cooled.

Resources

A metal ball and ring apparatus, a Bunsen burner.

Teaching guidelines

- Ask learners what they understand by the terms “expansion” and “contraction”.

Background knowledge

As more air is blown or pumped in, blowing and pumping becomes more difficult.

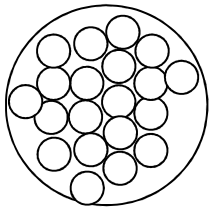
Activity 1	Demonstrate and explain expansion (in a metal ball and ring) Learner’s Book page 87

Guidelines to implement this activity

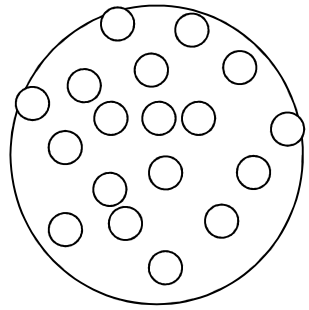
- This is a class activity. The teacher should demonstrate this activity.
- Explain what you are going to do to the class and ask them to answer the question to the activity in their workbooks.

Review Copy

Suggested answers



Before heating



After heating

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Copy it onto the board and ask learners to check their diagrams.

Unit 9 Pressure in gases

Learner's Book pages 88–89

Review Copy

Unit overview

This unit describes why gases exert pressure.

Resources

A glass, a piece of paper, water, materials: a metal tin with a lid or cap, water, Bunsen burner, a balloon, a soccer ball or bicycle tyre, a hand/bicycle pump, balloons.

Teaching guidelines

- Ask learners what happens when you blow up a balloon and then stop.

TIP! Have some balloons in the classroom and ask learners to blow them up and then stop.

Activity 1 Show that air exerts pressure

Learner's Book page 88

Guidelines to implement this activity

- This is a group activity.
- Read through the methods with the class and demonstrate Part A to the class
- Divide them into groups and ask learners to try the experiment.
- Ask them to write an explanation down for each part of the experiment.

Background knowledge

The collapsing can activity also works with plastic juice bottles. Use plastic which can withstand high heat (no. 5) and pour some boiling water from a kettle into the bottle and screw the lid on.

Suggested answers

- Part A – The air pressure on the outside of the paper covering the glass is greater than the pressure on the inside of the glass, so this pushes the paper against the glass, keeping the water inside.
- Part B – When heated, the air particles are driven out of the can so the air pressure inside the can becomes less than the air pressure on the outside of the can when the lid is closed. The higher air pressure on the outside forces the can to collapse.

Review Copy

Assessment guidelines

This activity is intended for informal assessment.
Use the checklist below to assess learners, allocating marks ouf of 12. Give learners feedback on their performance to prepare them for formal assessment.

Criteria The learner(s):	Yes	Partly	No
Carried out part A successfully	3	2	0
Carried out part B successfully	3	2	
Explained what happened in part A correctly	3	2	
Explained what happened in part B correctly	3	2	

Activity 2	Demonstrate how pumping a gas into the container increases the pressure Learner's Book page 89

Guidelines to implement this activity

- This is a group activity (five learners per group).
- Read through the activity with the class.
- Ask learners to write down the answers to the questions in their workbooks.

Suggested answers

Part A

2 By pumping more air into the balloon.√ (1)

Part B

1 Pumping more gas into the container increases the number of gas particles. And more gas particles means more collisions, which increases the pressure. (3)

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Allocate learners a mark out of four and give them feedback on their performance to prepare them for formal assessment.

Unit 10 Chemical reactions

Learner's Book pages 90–96

Review Copy

Unit overview

In this unit, learners will explore how atoms combine in chemical reactions.

Resources

An uncooked egg, beaker/glass jar, vinegar, clear limewater, beaker, drinking straw

Teaching guidelines

- Ask learners what they understand by the term chemical reaction.
- Ask for some examples.

Background knowledge

A chemical reaction is when one or parts of a chemical compound interact with one or part of another chemical compound to form substance/s which are different.

Practical investigation 1 Investigate the chemical reaction between egg shell and vinegar

Learner's Book page 91

Guidelines to implement this activity

- This is a group activity (five learners per group)

- Ask learners to record their observations in their workbooks and answer the questions.

Background knowledge

Egg shell is made of calcium carbonate. When this reacts with acetic acid (in the form of vinegar in this activity) calcium acetate is produced and carbon dioxide is given off.

Suggested answers

1 carbon dioxide ✓ (1)
2 calcium acetate,✓ carbon dioxide ✓ (2)
3 calcium carbonate,✓ acetic acid✓ (2)
[5]

Total: 5 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Ask learners to swop their books with a partner an give them a mark out of five.

Remediation/Remedial activity

Discuss the results of the experiment with the class and write the reaction up on the board.

Review Copy

Practical investigation 2 Investigate the chemical reaction between clear limewater and carbon dioxide

Learner's Book page 92

Guidelines to implement this activity

- This is pair or group activity (four learners per group).
- Ask learners to read through the method and carry out the activity.

Background knowledge

Limewater is a calcium hydroxide suspension. When this reacts with carbon dioxide, calcium carbonate and water are produced.

Suggested answers

1 Breathe.
2 Reactant.

3 Calcium carbonate.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested memorandum supplied above to assess learners informally. Discuss the answers with the class once the activity has been completed.

Unit 11 Careers that involve matter and materials

Learner's Book pages 94

Section overview

This section introduces some of the careers that one can do that involves matter and materials.

Teaching guidelines

- Ask learners what kind of jobs they think would involve matter and materials.
- Write their suggestions down on the board.

Background knowledge

Careers can include chemists, engineers, scientists, manufacturers, computer hardware developers

Review Copy

Activity 1	Read and talk about careers that deal with matter and materials Learner's Book page 95

Guidelines to implement this activity

- This is class activity.
- Ask learners to read the relevant careers profile/features and case studies and then have a class discussion using the questions in the activity.

Background knowledge

Organic chemistry is the study of substances that contain carbon. This is opposed to inorganic chemistry which is the study of chemical substances other than organic, although there is some crossover in this definition.

Suggested answers

Organic chemistry is the study of substances that contain carbon.
Accurate, patient, problem solver, innovative, mathematical

Assessment guidelines

This activity is not intended for assessment.

[PoA] Strand 2 Assessment: Practical task Compare and calculate the density of different materials

Learner's Book page 97

Guidelines to implement this activity

- This is an individual activity.
- Go through the information given in Figure 9 Learner's book page97 and ensure that learners understand the picture.
- Ask learners to show their calculation workings.

Background knowledge

Volume = length × breadth × height. Density = mass ÷: volume

1.18 m3✓	(1)
1.20,125 m3✓	(1)
2.1800 kg ÷ 8 m3 ✓= 100 kg/m3 ✓	(2)
2.2200 kg ÷ 0,125 m3 ✓= 1 600 kg/m3 ✓	(2)
2.32 700 kg ÷ 1 m3 ✓= 2 700 kg/m3 ✓	(2)
3.1Solid 2,✓ solid 1,✓ aluminium	(2)
3.2Solid 2,✓ aluminium,✓ solid 1	(2)
3.3Solid 1,✓ solid 2,✓ aluminium	(2)
4.1Solid 1✓	(1)
4.2Polystyrene or very light wood✓	(1)
5.113✓	(1)
5.2Gold: 79✓	(1)
5.3Gold✓(1), has a greater number of protons✓	(2)
	[20]
	Total: 20 marks

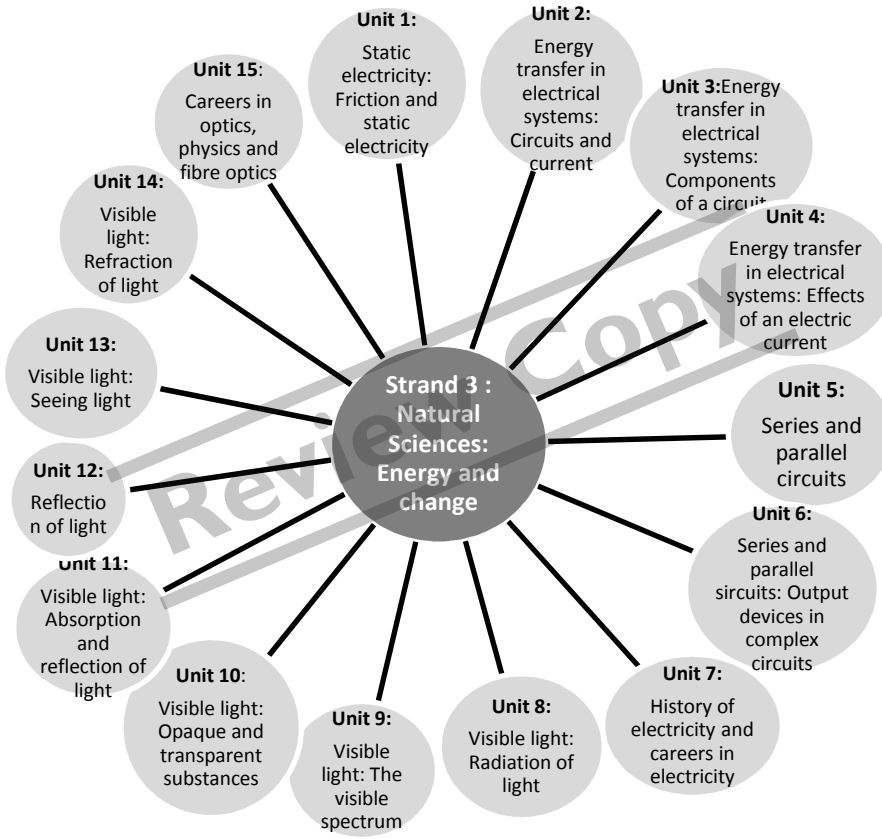
Review Copy

Assessment guidelines

- This activity is intended for formal assessment.
- Use the memorandum supplied above to assess learners. Allocate learners a mark out of 20 and record the marks for formal assessment.

Strand 3 Energy and change

Core concepts covered



Review Copy

Strand overview

In this unit, learners will find out about friction and static electricity. They will explore how energy is transferred in electrical systems through currents, and will be introduced to the components of an electrical circuit such as conducting wires, switches, batteries and resistors. They will learn about some effects caused by an electric circuit including heat, a magnetic field and electrolysis, as well as series and parallel circuits. This unit

moves on to some aspects of visible light and learners will find out about the radiation of light and the spectrum of visible light. They will also explore the concept of opaque and transparent substances, and learn about absorption and reflection of light, seeing light and refraction of light.

Content

Unit No.	Content	Pacing (Time allocation)	LB page	TG page
1	Static electricity: Friction and static electricity	2 hours	102	84
2	Energy transfer in electrical systems: Circuits and current electricity	1 hour	106	85
3	Energy transfer in electrical systems: Components of a circuit	2 hours	108	86
4	Energy transfer in electrical systems: Effects of an electric current	3 hours	112	87
5	Series and parallel circuits	2 hours	118	91
6	Series and parallel circuits: Output devices in complex circuits	1 hour	124	96
7	Series and parallel circuits: History of electricity and careers in electricity	1 hour	126	96
8	Visible light: Radiation of light	½ hour	130	98
9	Visible light: The visible spectrum	1 hour	134	100
10	Visible light: Opaque and transparent substances	½ hour	138	101
11	Visible light: Absorption and reflection of light	1 hour	141	103
12	Visible light: Seeing light	½ hour	146	106
13	Visible light: Refraction of light	1 hour	148	107
14	Visible light: Careers in optics, physics and fibre optics	½ hour	156	111

Review Copy

Assessment

The following activities in this Strand are suitable for formal assessment:

Activity				Assessment	
Type of activity	Activity	LB page	TG page	Assessment tool	TG page
Practical	Investigate the effect	119	00	Memorandum	92

activity	of more resistors in a series circuit				
Practical activity	Investigate effects of more resistors in a parallel circuit	121	00	Memorandum	93
Exemplar test	Exemplar test: Strand 3	159	00	Memorandum	112

Unit 1 Static electricity: Friction and static electricity

Learner's Book pages 102–105

Unit overview

This unit describes how friction charges atoms and how charges can attract or repel each other.

Resources

Comb, a plastic or Perspex ruler, a piece of synthetic fabric or silk, wool or nylon, small pieces of tissue paper or sawdust
Video clips of static electricity

Review Copy

Teaching guidelines

- Introduce static electricity by taking a plastic comb and rubbing it vigorously over some synthetic fabric; then hold it close to one of the learner's hair and ask the class to observe what happens. Their hair should stand up on end.

Background knowledge

Static electricity is generated by friction between two surfaces.

Activity 1 Investigate static electricity

Learner's Book pages 104

Guidelines to implement this activity

- This is a group activity (4 learners per group).
- Demonstrate this activity to the class first so they can see what to do and what to look for.

Background knowledge

Make sure that everything used in this activity is dry, otherwise it will not work properly.

Suggested answers

1 The paper or sawdust stuck to the ruler or plastic.

2 When the plastic or Perspex ruler was rubbed with the silk cloth electrons were transferred from the atoms on the surface of the Perspex ruler or plastic to the cloth. The plastic or ruler became positively charged. The cloth became negatively charged.

3 Individual answers.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Give learners feedback on their performance to prepare them for formal assessment.
- Discuss the answers to the activity with the class.

Remediation/Remedial activity

Revise the conclusions from this activity with the class to make sure they understand that the objects became electrically charged after rubbing.

Review Copy

Unit 2 Energy transfer in electrical systems: Circuits and current electricity

Learner's Book pages 106–107

Unit overview

In this unit, learners find out how an electric circuit works and what the various components of a simple electric circuit are called.

Teaching guidelines

- Read through this unit with the class and make sure they understand the meanings of current, complete circuit, filament and incandescent.

TIP! Write these definitions up on the board so that learners do not forget.

Background knowledge

It is important to teach learners that an electrical circuit will not work if it is not complete. When an electrical appliance does not work, it is because the circuit is not complete in some way. This could be in the form of a bulb that has blown a loose wire or another faulty component.

Unit 3 Energy transfer in electrical systems: Components of a circuit

Learner's Book pages 108–111

Unit overview

This unit describes some components of an electrical circuit. Learners will find out about conducting wires and how switches control electrical circuits and cells, which are sources of energy.

Resources

Conducting wires, switches, cells and batteries

Teaching guidelines

- Demonstrate to learners how you can open and close an electrical circuit by switching a light switch on or off.

TIP! Have a picture of circuit components on the classroom wall so that learners remember how to represent them.

Review Copy

Background knowledge

It is important to realise that the reason why any electrical unit does not work is because the circuit is incomplete. This means that one terminal must always come back and make a connection with the other terminal, however complicated the circuit may be.

Activity 1 Interpret and draw electrical circuit diagrams

Learner's Book page 111

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to study the photo of the circuit and try and work out how to draw the circuit diagram using the symbols discussed in this unit.

Suggested answers

Assessment guidelines

- This activity is not intended for assessment.

Remediation/Remedial activity

Give learners some different circuit diagrams to draw so they can practice.

Unit 4 Energy transfer in electrical systems: Effects of an electric current

Learner's Book pages 112– 117

Unit overview

This unit describes the energy transfer in electrical systems. Learners will find out about the heating effects of an electric current as well as what fuses and short circuits are. This is followed by an exploration of the magnetic effects of electric current as well as the chemical effects of electric current in solutions.

Review Copy

Resources

- a circuit board, 4 cells, a piece of nichrome wire or a strand of steel wool, connecting wires, a switch, a small bowl of water, three 1,5V cells, switch, connecting wires, magnetic compass, magnet, iron nail, piece of insulated copper wire with the insulation removed from both ends, iron filings or pins, copper chloride solution (CuCl2) in a glass jar or beaker, two carbon rods, two insulated copper leads

Background knowledge

Nichrome is a non-magnetic alloy of nickel, chromium and is usually used as a resistance wire. It was developed in the early 1900s. It has a very high melting point of about 1400 °C and is widely used in all sorts of electrical appliances such as hairdryers, toasters and electric ovens.

Activity 1 Investigate the heating effect of a current using a resistance wire

Learner's Book page 112

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Once the class has been divided into groups, read through the method to this activity and explain anything that learners do not understand.
- Ask learners to write down their observations and answer the questions in their workbooks.
- Ask each member of each group to check that the circuit has been set up correctly before closing the switch.

Background knowledge

Steel wool works just as well for this experiment if you cannot get hold of any nichrome wire.

Suggested answers

Results

Observation: Nichrome was cool at the start but became very hot when the switch was closed. It heated up the water when the wire was placed in the water.

1 Nichrome wire resists the current. So energy is transferred to the atoms of nichrome and they begin to vibrate more. Energy is transferred to the atoms and the wire starts to get hot. So nichrome is a conductor of electricity but not as good as copper.

2 We use the heating effect to heat the elements of geysers and kettles to provide hot water. We also use it for light. In light bulbs glowing white hot, wires that get very hot can start a fire. Fuses can be inserted into circuits so that they melt before the current gets too large and so protects the circuit from damage. Advantages are that we get heat and light that we can use. A disadvantage is that when wires become too hot a fire can start.

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the checklist below to assess learners, allocating them a mark out of 12.. Give learners feedback on their performance to prepare them for formal assessment.

Criteria	Yes	Partly	No
The learner(s):			
followed the instructions in the Learner's Book and understood what to do.	3	2	0
set up the circuit correctly.	3	2	0
wrote a conclusion to explain the results.	3	2	0
made an accurate prediction for an application.	3	2	0

Activity 2 Read about fuses

Learner's Book page 114

Guidelines to implement this activity

- This is an individual activity.
- Ask the learners to read the section on fuses in this unit and then answer the questions in their workbooks.

Suggested answers

1 To stop overheating and fires in electric circuits ✓ (1)

2 Because the thin wire burns out more quickly than the conduction wire✓ to break the circuit ✓before the conducting wire starts to burn and cause a fire in the circuit.✓(3)

3 If the electrical fault is not fixed the new fuses will also melt and burn out✓ (2)

[6]

Total: 6 marks

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 6 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Go over the answers to this activity on the board to make sure that all learners understand about fuses.

Activity 3 Investigate the magnetic effect of a current in a wire coil

Learner's Book page 115

Guidelines to implement this activity

- This is a individual, pair or group activity (5 learners per group).

- As this is a complicated activity it may be better to demonstrate this activity to the whole class first and then allow learners to do it for themselves.

Read through this activity with the class first before demonstrating it.

Suggested answers

Observations:

Steps	Observations
1	It swings towards the magnet
2	The needle does not move
3	The needle moves towards the wire
5	Nothing happens
7	They are attracted towards the magnet
8	The iron filings are not attracted by the magnet

1 There is a magnetic force field around a current carrying wire. This is useful as the magnetic effect can be turned on and off as the current is turned on and off.
2 They are used to carry scrap metal to an area and then release it into a pit.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Ask learners to share their answers with the rest of the class and ask them to mark their own work.

Review Copy

Remedial activity

Go over the results of this activity with learners who are struggling to find out where they have made their mistakes.

Extension/Extension activity

Ask learners to look up on the internet or in books for other examples of what electromagnets can be used for.

Activity 4 Investigate electrolysis of copper (II) chloride

Learner's Book page 117

Guidelines to implement this activity

- This is a group activity (4 learners per group).

Read through the method of this activity with the whole class and warn them of the dangers of working with copper chloride.

Background knowledge

Copper chloride solution gives off a poisonous gas and should not be ingested.

Suggested answers

Method

Nothing happens ✓ (1)
Results
The negative carbon rod becomes coated with a reddish brown substance- ✓ (1)
Bubbles from at the positive carbon rod. ✓. Yes, you could smell a smell similar to swimming pool water. ✓ (2)
The substance at negative electrode is copper✓ (1)
The substance at positive electrode is chlorine gas – ✓ (1).
Refer to diagram in LB p. 117✓✓✓✓ (5)
Conclusion
Electric current can break down substances ✓ (1)
The energy comes from the electrical energy in the battery ✓ (1)
The copper chloride solution was broken down into copper metal ✓ and chlorine gas. ✓ (2)

[15]

Total: 15 marks

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 15 and give them feedback on their performance to prepare them for formal assessment.

Unit 5 Series and parallel circuits

Learner's Book pages 118–123

Unit overview

This unit describes how components are arranged in series circuits and learners find out what the effect is of adding resistors to series circuits. They also learn how components are arranged in parallel circuits and what the effect is of adding resistors to parallel circuits.

Resources

- three 1.5V cells, three bulbs (resistors), switch, connecting wires, circuit board, pieces of different metal wire, such as copper, nichrome, tungsten or steel (a strand of steel wool), 1.5V bulb, a string of Christmas lights

Teaching guidelines

- Show learners a string of Christmas lights and plug them in. Take one of the bulbs out and see what happens to the circuit. Ask them whether the bulb components are connected in series or parallel.

Background knowledge

When components are connected in series, if one of these becomes faulty, the whole circuit will become incomplete and therefore not work. However, when components are connected in parallel and one of them becomes faulty, the circuit will remain complete in part and therefore electricity will still flow through the circuit.

Practical Activity 1	Investigate the effect of more resistors in a series circuit [PoA]

Learner's Book page 119

Review Copy

Guidelines to implement this activity

- This is a group activity (4 learners per group).
- Ask learners to read through the method and carry out the experiment in their groups.
- Ask them to record their observations and answer the questions in their workbooks.

Suggested answers

Method

1 Hypothesis: If more resistors are connected in series in a circuit, the bulbs get dimmer as there is less current.✓✓ Prediction: The more resistors, the dimmer the bulb gets.✓ (3)

2 Independent variable: number of resistors in series✓; Dependent variable: brightness of the bulbs.✓ (2)

3. Yes ✓all variables are kept the same ✓except the number of resistors or bulbs✓(3).

Number of resistors	Brightness of bulb(s)
1	Individual answer – highest value✓
2	Individual answer – in between✓
3	Individual answer – lowest value✓

(3)

2 All of the bulbs go out. ✓ (1)

3 The brighter the bulb, the more current is flowing. ✓✓ (2)

4 Resistors slow down flow of current. ✓ The more resistors, the less current can flow in the circuit, ✓ so bulbs are less bright ✓ (3)

5 Add more cells to the circuit ✓ (1)

Conclusion

1 As more resistors are added into the circuit in series, the bulbs get dimmer✓. If one of the light bulbs is disconnected they all go out in a series circuit✓ (2)

[20]

Total: 20 marks

Assessment guidelines

- This activity is intended for formal assessment.
- Use the memorandum supplied above to assess learners. Allocate learners a mark out of 20 and record the marks for formal assessment.

Practical Activity 2	Investigate effects of more resistors in a parallel circuit [PoA]

Learner's Book page 121

Review Copy

Guidelines to implement this activity

- This is a group activity (4 learners per group).
- Ask learners to read through the method and carry out the experiment in their groups.

Ask them to record their observations and answer the questions in their workbooks.

Suggested answers

1 If more resistors are connected in parallel in a circuit, the bulbs will shine just as brightly as more current will flow in the circuit. ✓✓ Prediction: More resistors do not make the bulbs less bright.✓ (3)

2 Independent variable: number of (resistors) bulbs in parallel✓; Dependent variable: brightness of bulbs in parallel ✓ (2)

Number of resistors	Brightness of bulb(s)
1	Individual answer – same brightness✓
2	Individual answer – same brightness✓
3	Individual answer – same brightness✓

(3)

2 Each resistor gets the same amount of current as if it was connected on its own. ✓✓ (2)

3 It goes out and the other two continue to glow. ✓✓ (2)

4 The remaining light bulb would continue to glow. ✓✓ (2)

Conclusion

1 When bulbs (resistors) are connected in parallel circuit, the bulbs shine just as brightly when more bulbs are added to the circuit. ✓✓✓ (3)

2 In parallel.✓ We can turn lights on and off individually, not all at once.✓ When one bulb fuses/goes out, the others carry on glowing. ✓ (3)

[20]

Total: 20 marks

Assessment guidelines

- This activity is intended for formal assessment.
- Use the memorandum supplied above to assess learners. Allocate learners a mark out of 20 and record the marks for formal assessment.

Review Copy

Activity 3 Compare effects of resistors in series and parallel

Learner's Book page 122

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to revise what they have learnt in this unit and complete the table in their workbooks.

Suggested answers

Number of resistors (bulbs)	Brightness of bulbs	
	Series circuit	Parallel circuit
1	Bright✓	Bright ✓
2	Less bright✓	Bright ✓
3	Dim ✓	Bright ✓

[6]

Total: 6 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Copy the answers onto the board and ask learners to mark their own work and allocate themselves a mark out of 6.

Activity 4	Investigate how different metals conduct electricity differently

Learner's Book page 123

Guidelines to implement this activity

- This is a group activity (4 learners per group).
- Divide the class into groups and read through the activity with them so they understand what to do.
- Brainstorm some ideas for this investigation and make keywords on the board so that learners have some idea of how to begin.

Suggested answers

2 Hypothesis: Different metals have different conducting abilities. Prediction: The bulb will shine more or less brightly depending on the metal used for conduction.
2 Independent variable: bulb brightness. Dependent variable: metal wires used.
3 Will make sure that the same voltage cell and bulb are used to test the circuit.
7 Individual answers

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the checklist below to assess learners. Give learners feedback on their performance to prepare them for formal assessment.

Criteria	Yes	Partly	No
The learner(s):			
followed the instructions in the Learner's Book and understood what to do.			
wrote a hypothesis and prediction.			
named the variables.			
stated how to make sure the test was fair.			
carried out the investigation competently and recorded results and conclusions.			
evaluated the investigation and suggested ways to improve it.			

Remediation/Remedial activity

Discuss how the different groups carried out their investigations and wrote up their work with the class.

Unit 6 Series and parallel circuits: Output devices in complex circuits

Learner's Book pages 124–125

Unit overview

This unit defines what an output device is and discusses different types of output devices such as LEDs, buzzers and motors.

Resources

LEDs, a small motor, a buzzer or beeper

Teaching guidelines

Show learners some examples of output devices.

Background knowledge

Electrical circuits are ultimately designed to have some kind of output which can be used somehow. Examples of output devices are numerous and are on virtually every electrical appliance that one can think of.

Review Copy

Extension/Extension activity

Ask learners to go to the library and find out what other devices are classified as output devices of an electrical circuit.

Unit 7 History of electricity and careers in electricity

Learner's Book pages 126–129

Unit overview

This unit explores the history of the discovery of electricity and describes various notable events that have occurred in the history of electricity in South Africa. Learners also find out what kind of careers one can embark on to do with electricity.

Teaching guidelines

- Show learners a short video clip of some historical events involving electricity.

TIP!	Make a timeline describing the history of electricity to stick on the classroom wall.

Background knowledge

Careers in electricity are vast. There are electrical engineers, circuit designers and printers, field service technicians, electronic test engineers, managers and research engineers.

Activity 1	Research and write about notable events in the history of electricity

Learner's Book page 128

Guidelines to implement this activity

- This is a pair activity.
- Take learners to the library and ask them to research one or two important events in the history of electricity in South Africa or elsewhere. They can look in books at home, speak to people or look up information on the internet.
- Ask learners to make notes and then compile their findings in a short report of not more than one page.

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the checklist below to assess learners, allocating marks out of nine.. Give learners feedback on their performance to prepare them for formal assessment.

Criteria	Yes	Partly	No
The learner(s):			
researched one or two historical events concerning electricity.	3	2	0
presented their findings logically in a report.	3	2	0
presented a report not longer than one page.	3	2	0

Remediation/Remedial activity

Ask learners to share their findings with other class members.

Activity 2	Find out about careers to do with electricity

Learner's Book page 129

Guidelines to implement this activity

- This is a group activity (4 learners per group).
- Ask learners to re-read the section on careers in this unit and discuss them.
- Ask them to speak to the Life Orientation teacher for information on the type of qualifications required for these types of careers.

Assessment guidelines

- This activity is intended for informal assessment.
- Ask learners to discuss the outcomes of their investigations with the class.

Unit 8 Visible light: Radiation of light

Learner's Book pages 130–133

Unit overview

In this unit, learners are introduced to visible light. They will explore luminous objects that give off their own light and non-luminous objects that do not give off their own light. They will find out how light travels in straight lines and how shadows form.

Resources

- a candle in a candle holder, matches, a drinking straw, a piece of paper or cardboard, cardboard shoe box with lid, strips of cardboard, scissors, tissue paper or waxed paper, pin, glue or sticky tape, tin foil

Review Copy

Teaching guidelines

- Brainstorm ideas with the class about radiation of light.
- Write keywords up on the board.

TIP! Have a poster up on the wall comparing the brightness of the Sun with other light sources such as stars, light bulbs and torches.

Background knowledge

The most powerful source of light is from the Sun. Any other source of light that we are exposed to is much less bright than the Sun. The easiest way to understand the concept that light travels in straight lines is to imagine what happens to sunlight when the Earth turns from West to East.

Activity 1 Investigate how light travels

Learner's Book page 131

Guidelines to implement this activity

- This is a pair activity.
- Read through the method of this activity with the class and warn them of the dangers of fire when using candles.
- Ask learners to answer the questions to this activity in their workbooks.

Suggested answers

1 No
2 The piece of a paper blocked out the light that was shining on the candle.
3 No
4 Light travels in a straight line. The light from the candle to the eye travelled in a straight line. When the straw was bent the light could not travel through the bend in the straw.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Ask them to swap their books with a partner and mark their work. Ask for a show of hands to determine how many of the class wrote down the correct answers.

Review Copy

Activity 2 Draw a ray diagram to explain a pinhole camera image

Learner's Book page 132

Guidelines to implement this activity

- This is an individual activity.
- Make a pinhole camera following the instructions in this activity so that you can demonstrate to the class how it works.
- Ask learners to write down the answers to the questions in this activity in their workbooks.

Suggested answers

1 smaller ✓ (1) Note that the size of the image increases when the object is moved closer to the pinhole or when the screen is further from the pinhole.
2 upside down ✓ (1)
3 drawing: give the learners 1 mark for each label and one mark for the drawing. ✓(5)

[7]
Total: 7 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of seven and give them feedback on their performance to prepare them for formal assessment.

Unit 9 Visible light: The visible spectrum

Learner's Book pages 134–137

Unit overview

This unit describes the colours of the visible spectrum of light. Learners find out how white light is bent and split into its different component colours. The formation of rainbows is explained and learners find out why there are different colours of light.

Resources

- A ray box, a triangular prism, a large piece of paper or a white wall to serve as a screen, a room that can be darkened, a piece of cardboard, a torch, sticky tape.

Review Copy

Teaching guidelines

- Show the learners a short video clip on light being split into its different component colours.

TIP!	Remember the order of the colours in the visible spectrum by remembering this sentence: ROY Gets Bananas In Venice.

Background knowledge

Prisms are quite difficult to work with and you will have to fiddle a little with the placement of the prism before the colour spectrum can be seen.

Activity 1	**Observe and record the sequence of colours in the visible spectrum**

Learner's Book page 135

Guidelines to implement this activity

This is a group activity (4 learners per group).
Read through the method of this activity with the class and ask learners to record the observations and results in their workbooks.

Suggested answers

Results

2 In order the colours are: red,✓ orange,✓yellow,✓ green, ✓ blue, ✓ indigo✓ and violet.✓ (7)

3 Violet has been refracted the most,✓ and red the least.✓ (2)

Conclusion

1 White light is a mixture of different colours✓. The light is refracted or bent and split up by the prism✓ (2)

2 pass light through 2 prisms ✓– the first prism splits the light✓ and the second prism recombines the colours to form white light.✓ The second prism should be placed next to the first prism and inverted.✓ (4)

Total: 15 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 15 and give them feedback on their performance to prepare them for formal assessment.

Review Copy

Extension/Extension activity

If you can, try the above experiment with 2 prisms to remix the colours of the spectrum to get white light.

Unit 10 Visible light: Opaque and transparent substances

Learner's Book pages 138–140

Unit overview

This unit describes substances through which visible light can pass (transparent substances) and substances through which visible light cannot pass (opaque substances). Learners also find out how shadows form.

Resources

- a torch, cardboard shape, white paper or wall, a darkened room

Teaching guidelines

- Aim a torch beam at a piece of wood, and then shine it through a piece of glass. Ask learners to suggest why light can pass through the glass but cannot pass through the wood.

Background knowledge

A good way to demonstrate the difference between opaque and transparent is to ask learners to look at different kinds of windows.

Activity 1	Draw diagrams to show how shadows are cast

Learner's Book page 139

Guidelines to implement this activity

- This is a group activity (4 learners per group).
- Ask learners to read through this activity and try the experiment out. Ask them to make notes on their observations and try and answer the questions.

Review Copy

Suggested answers

1 Nothing between it and the light source.
2 The cardboard blocks the light and prevents it from reaching the sheet of paper.
3 The shadow is the same shape as the cardboard.

Assessment guidelines

This activity is intended for informal assessment.
Use the memorandum supplied above to assess learners informally. Discuss the answers with the class and ask them to mark their own work.

Activity 2	Predict and investigate the effects of on a shadow of moving an object closer to or further from a light source

Learner's Book page 140

Guidelines to implement this activity

- This is a group activity (four learners per group).

- Based on the activity previously carried out, learners should be able to follow this investigation without much help.
- Ask them to write down their observations and answer the questions in their workbooks.

Suggested answers

1.1 shadow gets bigger
1.2 shadow gets smaller

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Write the answers on the board and ask them to mark their own work for informal assessment.

Remediation/Remedial activity

Practise ray diagrams on the board for learners who are struggling with this concept.

Unit 11 Visible light: Absorption and reflection of light

Learner's Book pages 141–145

Review Copy

Unit overview

This unit explains how light is absorbed and reflected by some materials. Learners find out how the absorption of different frequencies of light give materials different colours and how light changes direction when it is reflected.

Resources

- A mirror, a piece of paper, a pen, a blank sheet of A4 paper, a pencil, a mirror with flat edges and no frame, a support for the mirror such as a book so it can stand upright, a ray box, a protractor, a ruler, tin foil.

Teaching guidelines

- Show learners a short video clip on the absorption and reflection of light.
- Ask learners to brainstorm what they know about the meaning of reflection of light.

Background knowledge

Black objects are seen as black because they absorb all colours of the spectrum. White objects are seen as white because they reflect all colours of the spectrum. Coloured objects absorb all the colours of the spectrum except the colour that they are seen as.

Mirrors need to be smooth for reflected images to be perfect. When mirrors are not completely smooth as can happen with some inferior quality ones, the reflected images often look distorted. The ratio of the different regions of a person's image are different. For example, a person's legs may look very short while the torso is elongated – these kinds of mirrors are often set up deliberately at science centres or carnivals as the images are very funny.

Activity 1	**Demonstrate reflection by mirrors**

Learner's Book page 142

Review Copy

Guidelines to implement this activity

- This is an individual activity.
- Read through this activity with the class and ask learners to carry out the activity and write their answers down in their workbooks.

Suggested answers

1 When you move forwards your reflected image moves the same way ✓and the same distance that you move. ✓ (2)
2 When you move left or right in front of the mirror, your reflected image moves the same way✓ and the same distance that you move.✓ When you move left or right, your image moves in the same direction. ✓ (3)
3 The image is the same size. ✓ (1)
4 The image is turned around✓ and your name looks as if it is spelt backwards✓. (2)

Total: 8marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 8 and give them feedback on their performance to prepare them for formal assessment.
-

Remediation/Remedial activity

Go over the answers to this activity with the class.

Activity 2	Investigate how a mirror reflects a ray of light

Learner's Book page 143

Guidelines to implement this activity

- This is an individual, pair or group activity (4 learners per group).
- Read through the activity with the learners and make sure they understand how to use a protractor. It is important to emphasise that the mirror is placed vertically on the paper.

Background knowledge

If the mirror is not vertical, the reflected ray will not be at the same angle as when the mirror is vertical.

Suggested answers

Individual drawing

Assessment guidelines

- This activity is intended for informal assessment.
- Check that learner's drawings resemble that shown in Figure 2 and that all the labels are present.

Review Copy

Remediation/Remedial activity

Ask learners who are struggling to redo this activity, following the written instructions.

Activity 3	Observe the reflection of light off a rough surface

Learner's Book page 145

Guidelines to implement this activity

- This is a group activity (4 learners per group).
- Ask learners to follow the instructions in this activity and write the answers down in their workbooks.

Suggested answers

1 Yes.✓ The light rays were uniformly reflected from the smooth surface. ✓ (2)
2 No. ✓The light rays were not uniformly reflected and were scattered in different directions. ✓ (2)
3 Individual drawings with 2 labels per drawing.✓✓✓✓ (4)

Conclusion

Light rays are not uniformly reflected from rough surfaces. ✓ The reflected rays are scattered in different directions. ✓ (2)

[10]

Total: 10 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of ten and give them feedback on their performance to prepare them for formal assessment.

Unit 12 Visible light: Seeing light

Learner's Book pages 146–147

Review Copy

Unit overview

In this unit learners find out how the eye detects different frequencies of reflected light. They will also learn how we see images.

Teaching guidelines

- Show the learners a short video clip on how the eye sees light.

TIP! Have a poster pinned up on the wall showing the human eye structure.

Background knowledge

Iris colour of individuals is dependent on the amount of melanin pigmentation in the iris. Colours range from light brown to black and there is no blue or green pigmentation in the iris. Green or blue eyes are seen as a result of variable light scattering which occurs within the stroma of the eye.

Activity 1 Explain why we see different colours

Learner's Book page 147

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to write down their answers in their workbooks for a class discussion.

Suggested answers

1 The car reflects blue light. Blue light enters the eye. An image forms on the retina. Cone cells in the retina are stimulated by the light. They send nerve impulses through the optic nerve to the brain. The brain interprets the impulses as an image.
2 The sunflower reflects yellow light. Yellow light enters the eye. An image forms on the retina. Cone cells in the retina are stimulated by the light. They send nerve impulses through the optic nerve to the brain. The brain interprets the impulses as an image.
3 The apple reflects red light. Red light enters the eye. An image forms on the retina. Cone cells in the retina are stimulated by the light. They send nerve impulses through the optic nerve to the brain. The brain interprets the impulses as an image.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to discuss the answers to the questions in this activity and assess learners informally. Make sure that all learners contribute to the class discussion.

Review Copy

Extension/Extension activity

Ask learners to find out why colour-blind people cannot see colour as normal.

Unit 13 Visible light: Refraction of light

Learner's Book pages 148–155

Unit overview

In this unit, learners find out how transparent substances can bend or refract light. They also learn how light changes direction when it is refracted and how a lens can refract and focus light.

Resources

- a ray box or a torch, a piece of cardboard with a narrow slit, a rectangular block of glass or Perspex (parallel-sided prism) or a rectangular clear-glass container filled with water, paper, a ruler, a pencil, a protractor, a ray box, a triangular prism, a large piece of paper or a white wall to serve as a screen, a darkened room, a magnifying glass, an object such as a pencil sharpener or eraser

Teaching guidelines

- Demonstrate to learners how light can be bent when it is passed through a prism or show them a short video clip on refraction if you do not have a prism suitable for this.

Background knowledge

The most common example of refraction is seen in water and most people are accustomed to this but do not understand why.

Activity 1	Observe refraction in water

Learner's Book page 148

Review Copy

Guidelines to implement this activity

- This is a group activity (4 learners per group).
- Read through the activity with the class to make sure they understand what to do.
- Ask them to write their answers down in their workbooks.

Suggested answers

1 The pencil seems to be bent or broken. ✓ (1)

Conclusion

When light enters a transparent medium, such as water, it bends. ✓ The bending makes the light change direction as it travels from the air into the water.✓ (2)

[3]

Total: 3 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Ask learners to swap their workbooks with a partner and allocate each other a mark out of 3. Assess performance by asking for a show of hands of those who wrote down the correct answers.

Activity 2 Demonstrate refraction through a parallel-sided prism

Learner's Book page 149

Guidelines to implement this activity

- This is a group activity (4 learners per group).
- Read through this activity with the class and demonstrate what to do in the classroom before carrying the activity out in a dark room, so that learners can see.
- Ask learners to answer the questions in their workbooks.

Suggested answers

1 Bent. The light is refracted as it passes into another medium, i.e. the prism.
2 Individual drawing with the following labels: angle of incidence, normal, angle of refraction, incident light ray, refracted light ray, emergent light ray.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the checklist below to assess learners out of nine. Give learners feedback on their performance to prepare them for formal assessment.

Review Copy

Criteria	Yes	Partly	No
The learner(s):			
followed the instructions in the Learner's Book and understood what to do.	3	2	0
answered the question correctly.	3	2	0
produced a correctly labelled drawing.	3	2	0

Activity 3 Observe refraction and dispersal of light by a triangular prism

Learner's Book page 152

Guidelines to implement this activity

- This is a group activity (4 learners per group).
- Read through this activity with the class and demonstrate what to do in the classroom before carrying this activity out in a darkened room, so that learners can see.
- Ask learners to answer the questions in their workbooks.

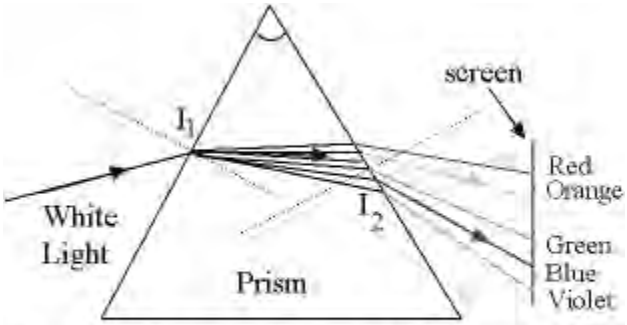
Suggested answers

1 No.✓ The emergent rays have been refracted by the prism. ✓ (1)

2 violet ✓ red✓ (2)

3 When light enters the prism it is refracted✓ and dispersed into different colours. This is because each wavelength refracts at a slightly different angle. ✓ (2)

4



Dispersion is the separation of light into its constituent colors.

✓✓✓✓✓ (5)

[10]

Total: 10 marks

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Ask learners to mark their own work and allocate themselves a mark out of 10 for informal assessment.

Remediation/Remedial activity

Revise the activity and explain anything that learners are having difficulty with.

Activity 4	Examine an object with a magnifying glass

Learner's Book page 154

Guidelines to implement this activity

- This is a group activity (4 learners per group).
- Ask learners what happens when they look through a magnifying glass.
- Ask them to read the activity through and answer the questions in their workbooks.

Background knowledge

If one holds a magnifying glass in the Sun so that the focal point of the refracted light hits a piece of paper, the concentration of heat into this focal point can be so high that it can cause the paper to burn.

Suggested answers

1 bigger✓ (1)
2 yes ✓ (1)
3 Individual drawing with labels (3)
✓✓✓✓✓ [Labels for: eye, light rays, image, lens, object [10]

Total: 10 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 10 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Draw the ray diagram on the board to emphasise to learners how magnification works.

Review Copy

Unit 14 Careers in optics, physics and fibre optics

Learner's Book pages 156–158

Unit overview

In this unit, learners will find out what kinds of careers one can have to do with light and vision.

Teaching guidelines

- Ask learners to brainstorm what kind of careers may involve light and vision.

Background knowledge

Careers involving optics, physics and fibre optics range from doctors who deal with human vision to technicians or researchers.

Activity 1 Discuss careers in optics, physics and fibre optics

Learner's Book page 157

Guidelines to implement this activity

- This is a class activity.
- Ask learners to read about the careers in optics, physics and fibre optics in this unit.
- Find out whether anyone in the class has a parent(s) who has such a career. If so, you can ask the learner to tell the rest of the class about it, or even ask the respective parent to come and give a talk to the class.
- Have a class discussion on these careers.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the checklist below to assess learners, allocating marks out of six. Give learners feedback on their performance to prepare them for formal assessment.

Criteria	Yes	Partly	No
The learner(s):			
contributed to the discussion in the class.	3	2	0
researched these careers.	3	2	0

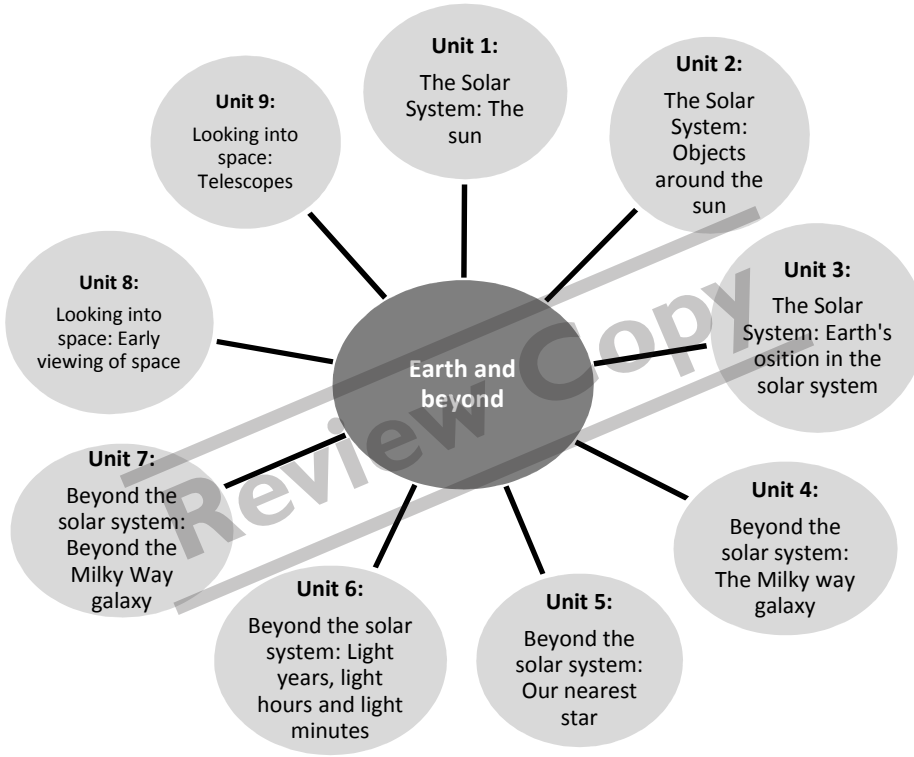
Review Copy

Extension/Extension activity

Ask learners to find out what kinds of qualifications are required for careers involving optics, physics and fibre optics.

Strand 4 Earth and beyond

Core concepts covered



Review Copy

Strand overview

In this strand the solar system is explained in detail. We start with the Sun and its role in our solar system. Our solar system is part of the Milky Way galaxy, which will be investigated and explored. This year will deal with outer space, what goes on beyond the Milky Way and the methods we use to capture images of objects so far away. The focus will be on realising that our solar system is only one of billions in the universe. Our galaxy is one of millions. The vastness of the universe is immeasurable and can only be estimated. The little we know about it pales in comparison to how much more there is to

know. Distances in space are vast, but we have devised a system to "measure" them, which will be explained during this strand. This term will be an exciting journey through the universe and will give you a better idea of how insignificant our planet, Earth, is compared to other celestial bodies.

Unit No.	Content	Pacing (Time allocation)	LB page	TG page
1	The solar system: The Sun	2 hours	164	116
2	The solar system: Objects around the Sun	4 hours	166	117
3	The solar system: Earth's position in the solar system	2 hours	172	125
4	Beyond the solar system: The Milky Way galaxy	2 hours	174	127
5	Beyond the solar system: Our nearest star	2 hours	178	129
6	Beyond the solar system: Light years, light hours and light minutes	2 hours	180	129
7	Beyond the solar system: Beyond the Milky Way galaxy	2 hours	182	131
8	Looking into space: Early viewing of space	4 hours	184	133
9	Looking into space: Telescopes	4 hours	188	138
Revision Week 9	Exemplar test: Term 4	1 hour	196	143
Revision Week 9	Exemplar exam: Terms 3 & 4	2 hours	198	144

9 weeks/27 hours

Review Copy

Assessment

The following activities in this term are suitable for formal assessment:

Activity				Assessment	
Type of activity	Activity	LB page	TG page	Assessment tool	TG page
Practical task	Construct a scale model of the solar system	170	121	Assessment table	121
	Record the position of the Southern Cross	187	136	Assessment table	136
Test	Exemplar test: Term 00	197	143	Memorandum (40)	143
Exam	Exemplar exam: Terms 03 and 04	198	144	Memorandum (70)	144

Unit 1 The Solar System: The Sun

Learner's Book pages 164–165

Unit overview

- The Sun is a star at the centre of our solar system and radiates heat and light energy in all directions.
- It is a star like billions of others in the universe.
- It produces energy by continuous nuclear reactions.
- It continuously produces large amounts of heat and light energy.

Teaching guidelines

- The learners need to understand that the Sun is a star and much bigger than the E arth.
- The Sun is only one of many stars in the universe. Those are usually the stars we see at night.
- The Sun, like all stars, produces energy inside its core by nuclear reactions.
- Explain nuclear reaction with the aid of Figure 2, page 165.
- Revise the concepts of radiation of light and heat energy from Grade 7.
- The video clips have excellent visual material of Sun flares (explosions).

Review Copy

Background knowledge

The physical properties and purpose of the Sun have been done in Grade 7. Learners' existing knowledge can be tested with a brief question and answer session.

Activity 1 The Sun produces its own energy Learner's Book page 165

Guidelines to implement this activity

- This is an individual activity.
- Learners are to complete it in writing in their workbooks.
- Encourage learners to write in full sentences where appropriate.
- Ask learners to leave lines open between answers for corrections.

Background knowledge

Learners should have a clear understanding of the composition of and activity within the Sun before they do the activity. Show the internet videos, if possible, or provide the learners with the web addresses.

Suggested answers

1 The Sun is not solid, but a giant ball of exploding gases.✓ It is essentially a giant nuclear reactor.✓ It fuses hydrogen atoms into bigger helium atoms inside its core.✓ This is called a nuclear reaction and is caused by extremely high pressure in its core.✓ These nuclear reactions create massive amounts of energy.✓ The chemical equation for this reaction is: H + H → He + energy.✓

(6)

2 The energy created inside the Sun is radiated in all directions ✓ as light energy and heat energy.✓This is why the Sun appears to shine all the time.✓ Some of the light and heat energy radiated by the Sun reaches Earth.✓ (4)

[10]

Total marks: 10

Assessment guidelines

- This activity is intended for informal assessment.
- Learners assess their own work or that of a peer.
- Use the suggested answers/memorandum supplied above. Allocate learners a mark out of 10.
- Learners create a recording table at the back of their workbooks where all informal marks are to be recorded.
- Provide feedback on their performance to prepare them for formal assessment.

Review Copy

Remediation/Remedial activity

Provide the learners with the model answers to do corrections. Explain difficult concepts again if necessary.

Extension/Extension activity

Learners showing much interest in this topic could be asked to find out how energy is generated in a nuclear power station and where in South Africa they would find one.

Unit 2 The solar system: Objects around the Sun

Learner's Book pages 166–171

Unit overview

- Our solar system consists of the Sun and different objects orbiting it.
- These objects include planets, their satellites, dwarf planets, asteroids and comets.
- The planets have similar and unique features.

- There are distinct differences between the inner and the outer planets.
- Asteroids occur in the asteroid belt between Mars and Jupiter.
- Comets originate from the Kuiper belt and the Oort belt.
- Objects in the solar system are held together by gravity.
- The solar system is shaped like a disk.

Teaching guidelines

- This unit has four activities of which Activity 3 is a practical activity for formal assessment. This activity requires substantial planning and execution time.
- The teacher should ensure that the classwork and written activities are completed timeously to allow sufficient time for the practical activity.
- Study and discuss the pictures and statistics of the different planets with learners in preparation for the first two assessment activities.
- Learners should be clear on the differences between a star, a moon and a planet. They should also have sufficient knowledge about the smaller, known objects in our solar system.
- They are not expected to know all the statistics off by heart, but should have a good idea of each planet's unique characteristics, its size relative to others, atmosphere, temperature and position from the sun.
- Guidelines for the practical activity are included under its heading further on in this guide.

Review Copy

TIP! Teach learners to make their own mnemonic to remember the planets in its order away from the sun. For example: Must Venus, Earth and Mars Join a Super Universe with Neptune?

Background knowledge

Learners should have fairly substantial knowledge about this content as it was introduced in Grade 6 and further explained in Grade 7. The content of this unit also bears relevance to this activity.

Activity 1	Interpret a table of facts about the solar system Learner's Book page 168

Guidelines to implement this activity

- This is an individual/class activity.
- Discuss the questions as a class before learners complete the answers in their workbooks.
- Learners must work on their own as this activity tests their ability to get information quickly by scanning a large amount of statistics.

Assessment guidelines

- This activity is intended for informal assessment.
- Give learners a set time of no more than 10 minutes to do this activity.
- They have to learn how to scan information quickly for relevant information.
- Learners mark their own work according to the suggested answers below, which should be on the board or displayed by overhead projector.
- No marks are allocated to this activity but it does serve as preparation for formal assessment as it indicates the type of questions learners could expect about this content.

Suggested answers

1 Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune.

2 A star is a ball of burning gas and creates its own energy and a planet consists of rock or gas, but does not burn or create its own energy. It only reflects the Sun's heat and light energy.

3 A moon is a satellite orbiting a planet.

4.1 Mercury – 88 Earth days

4.2 Neptune – 164,8 Earth years

4.3 Their distances are either nearer or further away from the Sun, which will cause a smaller or bigger orbit around the Sun.

4.4 Other planets do not have the conditions necessary for life, such as oxygen, correct temperature, fresh water and soil to cultivate food.

Review Copy

Remediation/remedial activity

- Explain the difficult concepts again while marking the activity with the learners.
- Learners may volunteer their own version of an answer for the teacher to accept or correct if necessary.

Activity 2	Compare and write about special features of the planets Learner's Book page 168

Guidelines to implement this activity

- This is a pair activity.
- Pairs should discuss possible answers, agree on it and record their answers neatly in their workbooks.
- Stress the importance of numbering answers correctly in preparation for formal assessments.

- Learners should also answer in full sentences unless otherwise indicated in the question.

Background knowledge

The information in this unit and any additional information the learners may have about the planets.

Suggested answers to observations

1 Venus✓ (1)

2.1 It is surrounded by a white cloud of sulfuric acid,✓ which reflects the sun's light.✓ (2)

2.2 Venus has an atmosphere that consists almost entirely (96,5%) of carbon dioxide ✓ (a greenhouse gas), which blocks the radiation of solar heat back into space.✓ Much more energy from the Sun is absorbed by its atmosphere than by other planets.✓ The result is that the planet-wide temperature is about 460 °C (860 °F) even at night. It has a dense atmosphere and no water.✓ (4)

2.3 (Any 5 facts) (5)

The atmosphere of Venus is dense and consists mostly of carbon dioxide and absorbs much more of the Sun's heat than Earth does.

The atmospheric pressure on its surface is 92 times that of the Earth.

No life is possible in these conditions.

The earth's atmosphere consists of a number of gases of which oxygen allows living organisms on it to breathe.

It has four layers with an extra ozone layer that deflects harmful rays from the Sun.

The atmosphere absorbs just enough of the Sun's energy to enable life on Earth.

The water vapour in the atmosphere creates precipitation, necessary for all living creatures.

Mars has a thin atmosphere (just one 100th the earth's), which does not trap much heat at all even though it is 95% carbon dioxide.

Because the atmosphere is so thin, the greenhouse effect is insignificant and Mars has rapid cooling between night and day.

When night comes the temperature can drop by over 82 ºC.

The large temperature differences create strong winds, which cause dust storms that cover the entire planet for a few months.

3.1 Saturn ✓ – it is made up of lumps of ice and different sized rocks, called space dust.✓ (2)

3.2 Yes, Jupiter,✓ Neptune ✓ and Uranus ✓ also have rings. (3)

3.3 (Learners' version of this – award 3 marks for logical facts.) (3)

It might be rocks broken off from asteroids or other planets.

Review Copy

The ice could have formed from water that evaporated into space from the planets and turned into ice due to extreme cold.
The rocks and lumps of ice are kept in orbit around these planets due to its gravity.
[20]

Total marks: 20

Assessment guidelines

- This is a challenge activity intended for informal assessment.
- Learners check their partner's answers against the model answers above.
- They award a mark out of 20 and record their marks in the assessment table in their books.
- Assist where necessary with judgment about an answer's validity.

Remediation/Remedial activity

- Supply learners with the model answers to do corrections in their workbooks.
- Explain work again after school or during bread, to those learners showing limited comprehension of this work. Try a different method, such as drawing on scrap paper, using tactile examples of planets. (Christmas tree decorations (baubles) work well).
- Advanced learners could also be asked to tutor a peer.

Review Copy

Activity 3 Construct a scale model of the solar system [PoA]

Learner's Book page 170

Guidelines to implement this activity

- This is a group activity requiring the participation of all the learners.
- Announce the date on which the activity will take place well in advance.
- This activity is best executed in a large open space, such as a quad or playing field.
- Each group is responsible for the required materials, except the moulding clay.
- The activity will only have educational value if it is planned and practised by the teacher prior to the event.
- Discuss the materials and method with the learners beforehand and listen to their suggestions as to the feasibility of this activity.
- Discuss the necessity in this activity to have different scales for size and distance.
- Planning for this activity must be done prior to the activity.
- Each group appoints a leader who has to distribute the tasks equally.

- Encourage all the learners to ask the group leader or educator if they are unsure of how to proceed. They should encourage and acknowledge each member's contribution with positive remarks.
- Discuss required behaviour for outside activities and make sure that every learner is aware that their conduct will also be assessed.
- Each group assembles and plots a solar system with markings as indicated in the learner's book.
- Once the solar system has been plotted out, the learners should walk around to get an idea of the vastness of the system and how planets compare in size.

TIP!

A good way to engage the whole class is to supply each group with different colours of play-dough to fashion their own sun and planets to scale. Ask a few learners to help with the dough-making after school or at home.
Recipe: Uncooked Play-dough
2 cups of plain flour
1 cup of salt
food colouring
enough water to make firm dough

Method:

Mix the ingredients together. Work into dough with hands. Learners could add small pebbles, sand or glitter for texture once the dough is distributed amongst the groups. Use different colours to depict the unique colours of some planets.

Review Copy

Background knowledge

Learners should know the content of the table on page 170 quite well. They can also be asked prior to the activity to investigate ways to illustrate the differences in the size of the planets with everyday products, such as fruit.

Assessment guidelines

- This activity is intended for formal assessment by the teacher.
- The teacher leads the class in a practical investigation of our solar system culminating in the actual building and plotting of a scale model.
- The teacher should engage with all the groups during preparation in the class and when the model is made and plotted outside. Provide constant input during the process to guide the learners in the right direction.
- Remind the learners that their conduct will also be assessed.
- The teacher will assess each group and learner according to the assessment table below.

- Be fair but also assertive with your comments, in other words, provide constructive criticism, clear indication of incorrect parts, positive remarks where due and suggestions how learners could improve in the different areas.
- It serves little purpose to praise all the learners for their efforts without making a clear distinction between the various performance levels. Learners need accurate and unbiased assessment to improve their performance.

Formal Assessment Construct a scale model of the solar system

Assessment table:

Name:				
Criteria	**Exceeded requirements**	**Sufficient performance**	**Needs to improve**	**Did not succeed at all**
The learner:				
engaged with the other group members and treated them with respect	4 marks	3 marks	2–1 mark(s)	0
committed to the project and participated with enthusiasm in discussions and decision making	4 marks	3 marks	2–1 mark(s)	0
executed his/her allotted tasks correctly and on time	4 marks	3 marks	2–1 mark(s)	0
The group:				
worked well together and executed the activity without assistance	4 marks	3 marks	2–1 mark(s)	0
The model was plotted correctly and each member participated in the activity	4 marks	3 marks	2–1 mark(s)	0
Final mark:				/20

Review Copy

Activity 4	**Present facts about objects in the solar system**
	Learner's Book page 171

Guidelines to implement this activity

- This is an individual activity.
- Learners complete the answers in their workbooks.
- Remind them to write neatly and in complete sentences.
- Discuss the wording of the questions and commands in numbers 1 to 6. Learners should know the difference between Explain, Describe, Discuss, Select, Design and Give.

- Learners should be taught how to read a question, how to decide on the action required, where to look for the answers and how to construct their answers properly.

Background knowledge

The learners apply the knowledge they have acquired up to now.

Suggested answers

1 Planets and dwarf planets differ in size, density and composition. Dwarf planets are tiny compared to other planets and consist of ice rock. They are more like comets.
2 Asteroids are small lumps of material orbiting the Sun. They consist mostly of rock, iron and other metals.
3 Most asteroids orbit in a zone between Mars and Jupiter called the asteroid belt.
4 Learners' own explanation. It will be correct if it mentions the following:
It is believed that asteroids formed in the same way that planets, moons and stars came to be, from pieces of rock and metal. Because of their proximity to Jupiter, they remained asteroids. Jupiter's gravity keeps the asteroids in orbit where they bump off each other, rather than combining into bigger objects.
5.1 The main difference between asteroids and comets is what they are made of. Asteroids are made up of metals and rocky material, while comets are made up of ice, dust and rocky material. Both asteroids and comets were formed early in the history of the solar system about 4,5 billion years ago. Asteroids formed much closer to the Sun, where it was too warm for ice to remain solid. Comets formed further from the Sun where ice would not melt.
5.2 Comets that approach the Sun reflect the sunlight and appears to shine. They lose material with each orbit because some of the ice melts and vaporises to form a tail.
6 Learners' own attempts. Their fact sheets will differ.

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers/memorandum supplied above to assess learners informally.

Remediation/Remedial activity

Provide the model answers and request learners to do corrections or additions.

Extension/Extension activity

Ask learners to find out if water draining out of a bath would spiral in a clockwise or anti-clockwise direction.

Answer: The direction in which water drains has absolutely nothing to do with the hemisphere in which you are. It is determined by the shape of the tub and the plumbing. It is true, however, that in the northern hemisphere, moving fluids are deflected to the left; this means that air masses moving north tend to curve to the west, and air masses moving south tend to bend east. This in turn causes a rotation in the air mass in a counter clockwise direction. In the southern hemisphere, the apparent deflection is to the right. A northward-bound air mass would therefore curve east and a south-bound air mass would curve west, giving rise to a clockwise rotation. This is called the *Coriolis effect*, and it determines the spin of very large rotating systems like hurricanes.

Unit 3 The Solar System: Earth's position in the Solar System

Learner's Book pages 172–173

Unit overview

- Earth's position in the solar system is unique.
- It is the only planet that supports life.
- Conditions supporting life on Earth include temperature, water, food and oxygen.

Review Copy

Teaching guidelines

- This section builds on material already taught and demonstrated in previous grades.
- As introduction, the educator could use a globe to ask revision questions about the Earth, its Moon and other objects moving in orbit around Earth, such as the international space station, Hubble telescope and various satellites strengthening and transmitting radio signals for communication.
- The objects mentioned above are all manufactured.
- Natural satellites of the Sun include the other planets, their moons, asteroids, space dust, dwarf planets, comets and meteors.
- Discuss the unique conditions on Earth that enable life.

TIP!

NASA's website has wonderful photos of all the objects in our solar system. If the Internet is not available at your school, download these images on a stick or CD and show it to learners on any available computer at your school. It could also be printed out and laminated at any Postnet outlet.

Background knowledge

Previous grades touched on this subject and learners could be asked what they already know about some of the objects.

Activity 1	Write about why conditions on Earth are ideal for life Learner's Book page 174

Guidelines to implement this activity

- This is a an individual/pair activity.
- Learners complete the answers in their workbooks for homework.
- Control if homework is complete the following day.

Suggested answers

1 A timeline describing the main dates will do. Earth formed around 4,54 billion (4,54×109) years ago by accretion from the solar nebula. Volcanic outgassing likely created the primordial atmosphere, but it contained almost no oxygen and would have been toxic to humans and most modern life. Much of the Earth was molten because of extreme volcanism and frequent collisions with other bodies. Over time, such cosmic bombardments ceased, allowing the planet to cool and form a solid crust. Water that was brought here by comets and asteroids condensed into clouds and the oceans took shape. About 4 billion years ago, Earth was finally hospitable to life, and the earliest forms that arose were algae, which enriched the atmosphere with oxygen through photosynthesis. Life on Earth remained small and microscopic for at least one billion years. About 580 million years ago, complex multicellular life arose, and during the Cambrian period it experienced a rapid diversification into most major phyla. Around six million years ago, the primate lineage that would lead to chimpanzees (the closest relatives of humans) diverged from the lineage that would lead to modern humans.

2 The present atmosphere contains about 21% oxygen while the ancient atmosphere contained none at first and then it slowly increased over billions of years.

3 No animal life would have formed, as animals have to breathe oxygen to survive. It is doubtful that plant life would have ever evolved into complex systems.

4 temperature, water, sunlight and oxygen

5 The temperature of the Earth's surface is neither too hot or too cold. The average temperature of the surface is about 16 ºC and ideally suited to sustain life.
The Earth is the only planet with oxygen. Earth's atmosphere contains about 21% oxygen enabling animals to breathe. The atmosphere also forms a protective screen around the Earth, deflecting harmful rays from the Sun, but at the same time

Review Copy

preventing too much heat escaping from the Earth's surface. It keeps temperatures at a level where life is possible.
The Earth's surface consists of 71% water. It is the only planet where water is found in liquid form. Plants and animals need water to survive.
The light and heat energy from the Sun sustains food chains on Earth. Our distance from the Sun ensures just enough energy to sustain life. Plants convert it into food through photosynthesis. Animals eat the plants and transfer the energy up the food chain.

Assessment guidelines

- This is an informal assessment of a written activity.
- Learners swop books for marking according to the suggested answers above.

Remediation/Remedial activity

Discuss the model answers with the learners and explain again if necessary. Learners correct their answers if necessary.

Unit 4 Beyond the solar system: The Milky Way galaxy

Review Copy

Learner's Book pages 175–177

Unit overview

- Our solar system is in the Milky Way galaxy.
- A galaxy consists of gases, dust and billions of stars held together by gravity.
- The milky way galaxy is shaped like a spiral.

Teaching guidelines

- Show learners the video clips if possible. It will provide ample background to support the text in this unit.
- Learners should know how our solar system fits into the Milky Way galaxy.
- Discuss the unique shape of the Milky Way as well as the myths surrounding the creation of this galaxy.

Background knowledge

This is the learners' first introduction to the Milky Way. The text in this unit will provide sufficient background necessary to complete the activity.

Activity 1	Demonstrate and draw the spiral shape of the Milky Way Learner's Book page 177

Guidelines to implement this activity

- This is a class demonstration with an individual written activity afterwards.
- This is a simple but effective practical activity.
- Bring a collection of bowls to class to see if the pattern differs from bowl to bowl.

Background knowledge

The text in this unit and the video clips will provide the knowledge required for this activity.

Suggested answers

1 A galaxy is a collection of billions of stars ✓consisting of gas (hydrogen) and dust ✓that orbits around a central point.✓ It is bound together by gravity.✓ (4)

2 The Milky Way galaxy is shaped like a disc. From above it looks like a whirlpool ✓ with many spiral arms winding outwards from the centre of the galaxy.✓ It has a bright bulge at the centre comprised of older stars.✓ The wide band of this galaxy appears whitish because the stars in this band are closer together ✓ than the other stars in the sky. (4)

3.1Learner's own attempt. (1)

3.2Learner's own attempt. (1)

[10]

Total marks: 10

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers/memorandum supplied above to assess learners informally. Allocate learners a mark out of 10 to record in their books.
- Provide feedback to prepare them for formal assessment.

Remediation/Remedial activity

Learners do corrections from the suggested answers above.

Extension/Extension activity

Learners who are interested can do research on any other known galaxy in space and report their findings to the class.

Unit 5 Beyond the solar system: Our nearest star

Learner's Book pages 178–179

Unit overview

- The Sun is the nearest star to Earth.
- Our nearest neighbouring star is Alpha Centauri, the brighter of the two pointers of the Southern Cross constellation.

Teaching guidelines

- The Sun is a known concept and learners should be able to share their knowledge about it. Revise briefly.
- The main focus in this unit is on another star, called Alpha Centauri.
- Discuss the relevant text and diagrams with the learners.
- The Southern Cross constellation will be discussed in Unit 8.
- The learners should memorise the names of the three main stars of Alpha Centauri.
- Explain the concept of distance measured in time (light years).
- Show the video clips as learners need to see the concepts as well as hearing about it.

Review Copy

Unit 6 Beyond the solar system: Light years, light hours and light minutes

Learner's Book pages 180–181

Unit overview

- Astronomers 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.
- Alpha Centauri is 42 trillion km away from Earth.
- 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.

Teaching guidelines

- The learners have to understand and be able to apply the concepts of light years, hours and minutes.
- The measuring units we use on Earth are totally inadequate when measuring distance in space.
- The concept of looking back in time should be explained carefully.

TIP!	Ask the learners if anyone has ever had an experience with sound echoing back to you, like shouting in a cave. Or having a delay when talking to someone far away on the phone. Or watching television when the sound you hear and the picture you see are not synchronised. Use this delay as basis to explain that the light that we see now has already travelled 8.3 light minutes.

Background knowledge

This concept was introduced to learners in Grade 7. The content in this unit add to their existing knowledge.

Activity 1	Calculate distances using light	Learner's Book page 181

Guidelines to implement this activity

- This is a pair activity.
- Learners discuss the activity and calculate the distances together.
- They record their answers in their workbooks.

Review Copy

Background knowledge

Learners use the knowledge gained in Grade 7 together with the content in this unit as reference to complete the activity. Their mathematical knowledge will also help with the calculations.

Suggested answers

1.1 Light always travels at the same speed. The speed of light (usually denoted as c) is a physical constant of exactly 299,792,458 metres per second.
For the purpose of this activity we will round it off to 300 000 000 metres per second.
To find a light minute in metres, multiply 300 000 000 metres times 60
OR 300 000 km × 60.
The answer is 18 million km per light minute.

1.2 To calculate the distance covered in one light hour, the answer of the previous calculation has to be multiplied with 60 again. (60 minutes in an hour)
18 000 000 km × 60 = 1080 000 000 km are covered in a light hour.

2 13 × 1080 million km = the diameter of our solar system = 14 040 million km

3.1 1 light year = 10 trillion kilometres

4,2 light years = (10 000 000 000 × 4,2)

4,2 light years = 42 trillion kilometres

3.2 Answers will differ.

It is the learner's current age in months minus (4 × 12) + 2 ½ months.

For example: (14 a and 6 months × 12) – (4 ×12) + 2,5

(14 ×12) + 6 – (4 ×12) + 2,5 months

174 months – 50 ½ months

Answer = 123 ½ months or 9 ½ years old

Assessment guidelines

- This activity is intended for informal assessment.
- Learners use the suggested answers/memorandum supplied above to assess their answers informally.

Remediation/Remedial activity

Explain the calculations used to get to the answers step by step on the board or overhead projector. Ensure that learners pay attention as all the zeros might be confusing to some learners.

Extension/Extension activity

Calculate the distances of some planets in light years to reinforce the method.

Review Copy

Unit 7 Beyond the solar system: Beyond the Milky Way galaxy

Learner's Book pages 182–183

Unit overview

- Billions of other galaxies exist beyond the Milky Way galaxy.
- People have seen a lot of the universe already, but it is so vast that there remains a lot that has to be seen still.
- Galaxies are classified according to their shapes.

Teaching guidelines

- Learners should be made to realise that the Universe stretches far beyond our solar system and galaxy.

- Scientists have explored our solar system and even the space beyond the Milky Way galaxy with powerful instruments.
- Explain the concept of observable universe – that our galaxy is one of billions of galaxies in the Universe, that have seen/observed by astronomers. Based on what have been observed of the universe, scientists make estimations as to how much more of the universe we have not seen yet.
- Galaxies are grouped into clusters.
- The shape of galaxies can be spiral, barred spiral or elliptical. Some have no definite shape.
- Explain the Magellanic clouds and Andromeda galaxies that fall outside our own galaxy by studying the photographs on page 183.

TIP!

Ask learners about the most people they have ever seen gathered in one place, for example at a concert of an international star or an important rugby game. Explain that if all those people were stars, they would have made up a small galaxy in the universe. Now imagine that one constellation multiplied by a million and that answer multiplied by another 1 000. That would constitute more or less the number of galaxies in our universe.

Background knowledge

The content of this unit builds onto the knowledge gained up to now.

Review Copy

Activity 1 **Identify and explore different types of galaxies**

Learner's Book page 183

Guidelines to implement this activity

- This is a group activity (5 to 6 learners per group) in which learners will come to understand more about the shape of galaxies.
- Learners are warned beforehand of the research that each group has to do. Each group member has to contribute some research and pictures of galaxies.
- The group discusses the shape of four types of galaxies and the scribe records their answers as well as the answers of the questions up to 4.
- Number 5 is a practical demonstration. Make the dots on the balloon with a permanent marker (tin tip).

Suggested answers

1 A spiral galaxy: like the Andromeda and the Pinwheel galaxy. Disc shaped as seen from the inside. From above it looks like a whirlpool with many spiral arms winding outward from the centre of the galaxy. Sometimes it has a blue disc of outer, younger stars and a bright blue bulge at the centre, comprised of older stars.

Our Milky Way galaxy was once considered an ordinary spiral galaxy. Astronomers first began to suspect that the Milky Way is a barred spiral galaxy in the 1990s. Their suspicions were confirmed by the Spitzer Space Telescope observations in 2005, which showed the galaxy's central bar to be larger than previously suspected. This is called the barred spiral galaxy.

There are also elliptical galaxies and irregular galaxies. Elliptical galaxies contain older stars and very little gas and dust. They can be different shapes ranging from round, to flattened, elongated spheres. Centaurus A (NGC 5128) is an example of this.

An irregular galaxy has an undefined shape and has lots of young stars, dust and gas. Irregular galaxies typically originate from disruption by the gravitational pull of neighbouring galaxies. Such interactions between nearby galaxies, which may ultimately result in a merging, sometimes induce significantly increased incidents of star formation leading to starburst galaxies. Smaller galaxies lacking a coherent structure are referred to as irregular galaxies.

2 Learners' own research should have names and pictures of at least one example of each type.

3 Edwin Hubble – Discovered Cepheid, a star in the Andromeda galaxy.

4 Scientists believe that the observable universe is a spherical ball, meaning that wherever the observer stands it stretches out the same distance in all directions. The diameter of the observable universe is estimated at about 93 billion light years), putting the edge (radius) of the observable universe at about 46 to 47 billion light years away.

5 Practical demonstration to illustrate how the universe is expanding and objects in it can drift apart.

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Learners use the suggested answers/memorandum supplied above to assess their answers informally.

Extension/Extension activity

Advanced learners can do research on a lesser-known galaxy and share their findings with the class.

Unit 8 Looking into space: Early viewing of space

Learner's Book pages 184–187

Unit overview

- The stars that we see depend on the time of year, the time of night and the place from where we view the sky.
- People identified patterns formed by stars, called constellations.
- People used constellations to learn the positions of the stars.
- Different cultures identified their own constellations and told legends or myths about them.

Teaching guidelines

- Explain why stars and constellations of stars are visible in the universe.
- Discuss the star patterns in constellations with the aid of the pictures in the learner's book as well as the video clips under resources.
- Some constellations, such as the Magellanic clouds, are only visible from the southern hemisphere. Others move to a different part of the sky each month due to the Earth's movement. Learners should have a clear understanding of this fact.
- Show more examples of star maps and engage learners in a class discussion.
- Identify as many constellations as possible and encourage learners to do research about the well-known star signs, such as Virgo, Pisces, Taurus, and so on.
- Read about early myths and star stories.

Review Copy

TIP! Try to visit a planetarium where the content of this unit could be experienced first hand.

Background knowledge

Do as much reading and research on this subject as possible. Teachers need to be well versed on this subject to present it with confidence. The Southern Cross in particular has significant value for learners in the southern hemisphere as most of them would have heard how it can help determine direction.

Activity 1 **Observe and record the positions of the planets**

Learner's Book page 186

Guidelines to implement this activity

- This is group activity (4 learners per group).
- Each group member will record the positions of Venus, Jupiter and Mars for at least two nights in one week.
- Explain to the learners how they should identify the three planets.
- Those with telescopes may report their observations to the class.

Assessment guidelines

- This activity is not intended for assessment.
- It is a practical activity allowing the learners to observe and discuss their findings.
- The focus in this activity is to get the learners to engage in conversations about objects in the universe and its significance to us.

Activity 2	**Use star maps to identify constellations** Learner's Book page 186

Guidelines to implement this activity

- This is a whole class/group activity.
- The teacher decides to implement the activity as a class or group activity depending on the available resources.
- The aim is to guide learners to recognise the patterns of constellations on star maps.
- First allow them to try and identify the patterns named in the activity on their own.
- Revise the names of the constellations and their brightest stars continuously.
- Ensure that learners know how the Southern Cross could be used to determine south.
- Use a bigger star map and help learners to recognize and identify other well known constellations.
- The resources listed below have exceptional visual materials to assist learners with this activity.
- Copy the checklist and hand out to each learner. Explain that they need to be honest to allow the educator to see who might need extra instruction.
- They will paste it into their workbooks after completion.

Review Copy

Resources

The NASA website offers a variety of games and activities that relate to constellation placement and stories. Take advantage of the constellation finder or the space exploration game available on the website.

Assessment guidelines

- This activity is a demonstration and will be assessed informally with a checklist completed by each group member.

- The learners should know that assessment in this instance is about determining how much of the content they understand and are able to apply.

Suggested answers

- This assessment focusses on identification of constellations.
- Learners will do self-assessment and indicate on the checklist if they were able to identify or find the assigned constellations.

Name:	Yes	Partly	No
Criteria:			
I found it easy to identify the Southern Cross, its two pointers and the constellation Taurus in Figure 7.			
I was able to identify Antares and Scorpius on the star map in Figure 4.			
I needed assistance to find Orion and its two brightest stars on the star map in Figure 6.			
I managed to find at least 3 other constellations and the planet Venus on the star map.			
The constellations I found on the map are:	1	2	3

Activity 3 Record the position of the Southern Cross [PoA]

Learner's Book page 187

Review Copy

Guidelines to implement this activity

- This is a pair activity.
- Announce the activity a week prior to allow learners to assemble the required material/equipment.
- Learners divide a blank A4-page into six equal blocks. Draw the Southern Cross constellation in each block. This will be stuck onto the cardboard to indicate its position at every sighting.
- Explain to the learners what they have to do.
- Pairs observe and record the position of the Southern Cross several times for two months.
- The aim is to have them track the movement of the constellation across the southern sky.

Assessment guidelines

- This is a practical activity, intended for formal assessment.
- Learners observe and record the position of the Southern Cross for two months.

- They work in pairs and present their data with a written explanation of the result.
- They discuss and write the answers to the questions in the activity.
- Assess each pair with the assessment table below.

Activity 3	**Formal assessment**	Learner's Book page 187

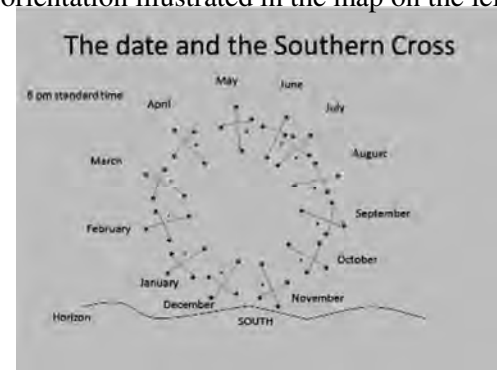
Record the position of the Southern Cross

Names:				
Criteria	**Exceeded requirements**	**Sufficient performance**	**Needs to improve**	**Not succeeded at all**
Each pair:				
understood the activity and worked well together with enthusiasm towards its completion	4 marks	3 marks	2–1 mark(s)	0
showed sufficient evidence of data collected over two months cardboard showed the Southern Cross positions correctly.	4 marks	3 marks	2–1 mark(s)	0
arrived at the correct result inferred from their recorded data (Question 1)	4 marks	3 marks	2–1 mark(s)	0
correct explanation (Question 2)	4 marks	3 marks	2–1 mark(s)	0
answer is correct (Question 3)	4 marks	3 marks	2–1 mark(s)	0
Final mark: 20				

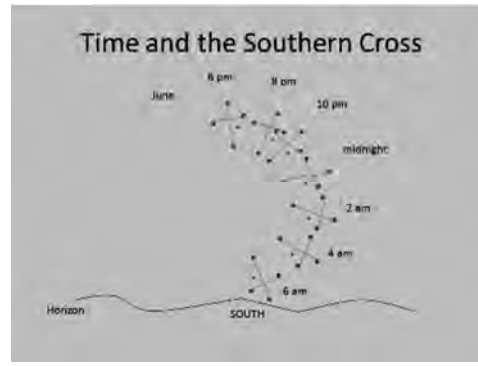
Review Copy

Suggested answers to Question 1 to 3

1 The Southern Cross not only spins around the southern sky once a year, it also does a complete circle each 24 hours. Actually it makes the complete circle in 23 hours 56 minutes and 4 seconds or one sidereal day. The approximately four minutes difference between an ordinary day and a sidereal day is significant because it makes the Southern Cross rise four minutes earlier each day, which is 30 minutes a week or two hours per month. And those two hours a month leads to the monthly change in orientation illustrated in the map on the left.



2



2 Answer explained above. See the image on the right showing the changing position of the Southern Cross from day to day during one month.
3 All sky maps are used to locate stars and other objects in the sky for a certain date, time and observing location. Just like the Sun moves across the sky during the day the stars will move across the sky during the night. Most of the stars will rise in the east and set in the west. The northern stars will circle the polar region in a counter clockwise direction. Therefore, different sky maps are used throughout the night to indicate the positions of the stars.

See website: http://www.stargazing.net/david/constel/skymapindex.html

Unit 9 Looking into space: Telescopes

Learner's Book pages 188–196

Unit overview

- Optical telescopes collect visible light from distant objects to form an image.
- Refracting and reflecting optical telescopes use different lens systems.
- SALT is a refracting telescope that uses a combination of 91 computer-controlled lenses.
- Astronomical telescopes, such as the Hubble, are launched into an orbit around the Earth to overcome disturbances caused by the atmosphere.
- Radio-telescopes collect information from space that is not visible to the human eye.
- South Africa is ideally situated to host the major part of the world's largest radio telescope, the SKA.

Review Copy

Teaching guidelines

- It would be ideal if the learners could be taken on a field trip to an observatory or planetarium.
- If this is not possible, try to get hold of an amateur telescope to show learners how it works.
- There might be amateur astronomers in your town that could do a presentation at school. Ask around.
- The video clips listed under resources provides exceptional visual material on various telescopes

TIP! Show learners a hand lens, mirrors that enlarge, pair of reading glasses, a pair of binoculars, any old model cameras. Use it to introduce the concept of telescopes with different lenses.

Background knowledge

The information below might be useful to provide background and additional facts to support the content of this unit.
Galileo is often credited with the invention of the telescope, but this is incorrect. Although he did not invent it, he did improve it – a lot. He didn't name the telescope either. That honour went to Greek mathematician Giovanni Demisiani, who gave the instrument its name when Galileo presented the instrument at the Academia dei Lincei, a science society in Italy, in 1611. Telescope is from the Greek roots tele (meaning "far") and skopos (meaning "seeing"); so the word literally describes what the instrument does.

Types of telescopes:

- astronomical telescope
  any telescope designed to collect and record electromagnetic radiation from cosmic sources
- collimator
  a small telescope attached to a large telescope to use in setting the line of the larger one
- equatorial
  a telescope whose mounting has only two axes of motion, one parallel to the Earth's axis and the other one at right angles to it
- solar telescope
  a telescope designed to make observations of the Sun
- transit instrument
  a telescope mounted on an axis running east and west and used to time the transit of a celestial body across the meridian
- optical telescope
  an astronomical telescope designed to collect and record light from cosmic sources
- radio reflector, radio telescope
  astronomical telescope that picks up electromagnetic radiations in the radio-frequency range from extra-terrestrial sources

Source: http://www.vocabulary.com/dictionary/telescope

Review Copy

Activity 1	Draw, label and explain how an optical telescope works Learner's Book page 190

Guidelines to implement this activity

- This is an individual activity.
- Learners follow the instructions in the Learner's Book and complete the drawing in their workbooks.
- Repeat the rules about scientific drawings explained earlier in this guide.
- Warn learners that sloppy work will not be acceptable and will have to be redone.
- Explain the distinction between optical and radio telescopes clearly.
- Compare the SALT telescope and the SKA-project

Background knowledge

Explanation of the workings and parts of an optical telescope in this unit.

Suggested answers

1 Their drawings should resemble those on page 189. Learners have to draw both telescopes as they are both examples of optical telescopes. (2)
2 The path of the light rays (arrows) should be tracked in colour pencil. (2)
3 Labels must be correct as on page 189. (6)
4 Explanatory sentences with labels:
4.1 eyepiece – the part through which the observer looks
4.2 distant object – reflecting or radiating light energy
4.3 light – available light energy from a distant object is collected
4.4 flat mirror – reflects the image that the observer sees through the eye piece
4.5 objective lens – refracts the light to form an image visible through the eyepiece
4.6 objective mirror – focusses light on objective mirror which reflects it onto the flat mirror (6)
[16]
Total marks: 16

Review Copy

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers/memorandum supplied above to assess learners informally. Allocate learners a mark out of 16 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Learners that performed less than satisfactory should do corrections according to the suggested answers. Check their corrections.

Extension/Extension activity

Advanced learners can do research on different sizes/strengths and prices of telescopes recommended for amateur astronomers.

Activity 2	Present a poster about a telescope	Learner's Book page 193

Guidelines to implement this activity

- This is a group activity (five to six learners).
- Learners follow the instructions in the Learner's Book and discuss it in their groups.
- The research and different requirements for the poster should be equally distributed amongst the group members and should be completed at home.
- The poster may be assembled in class and displayed after assessment.

Background knowledge

Explanation of the workings and parts of an optical or radio telescope in this unit.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the checklist to assess groups informally.
- Checklist: Activity 2 Learner's Book page 193

Review Copy

Activity 3	Discuss career opportunities in SA in astronomy Activity	Learner's Book page 194

Guidelines to implement activity

- This is a group activity. (Groups of 4 to 5.)
- Learners read the notes on pages 193–194 and plan the distribution of work.
- They bring their research to school and process it under the given headings in class.
- Assist if necessary.
- Each group appoints a spokesman to share the relevant information with the class.
- The summaries of each group are tacked to a career-poster, which will be displayed in class.

Resources

Notes in Learner's Books and supplied website addresses.

Suggested answers

Learners' answers will differ but should include all the headings with relevant information. The websites provide ample information about the various careers related to these projects.
Studies could be in-service training, university degrees or technical diplomas ranging from 1 to 4 years. Post-graduates can apply to do research at these facilities. Scholarships and intern-programmes are available as study-aid. Initial job placement will be at these locations in South Africa but may also entail placement in any of the countries that are part of the SKA project or funding the SAAO.

Assessment guidelines

- This activity is intended for informal assessment.
- No marks will be allocated as this activity culminates in a class discussion with input from the various groups

Criteria:	Yes	Partly	No
The group:			
did sufficient research and translated their information successfully onto the poster			
required minimum assistance and worked together to complete all the requirements on time			
drawings are informative, neat with correct labels and captions			
the location of the telescope was illustrated on a map and a list of its discoveries was included			

Review Copy

- Structure the discussion to give the spokesman of each group an opportunity to relay their summaries.

Strand 1 exemplar test memorandum

Learner's Book page 61

1 I breathe, because I need oxygen✓ from the air for respiration.✓ This process releases energy✓ from glucose.✓ The waste product I breathe out is carbon dioxide.✓ (5)

2 C✓ 2;✓
A✓3;✓
B✓ 1✓ (6)

3.1 Habitat is a region in which living things exist,✓ an ecosystem is the interaction between a community and its habitat.✓ (2)
3.2 Population is a single type of species,✓ a community is when more than one type of species co-exists. ✓ (2)
3.3 A biotic factor is a living part of an ecosystem,✓ an abiotic factor is a non-living part of an ecosystem.✓ (2)

4.1 The Pacific sea otters were hunted and their population decreased. ✓ (1)
4.2 Decreased the sea otter populations,✓ they are the predators of kelp-grazing sea urchins whose population now increased,✓ they eat kelp and so the kelp forests collapsed✓ as the urchin population was so high.✓ (4)
4.3 Reduce the urchin population.✓ (1)
4.4 Sea otter would become extinct. ✓ (1)
4.5 They are very spiny✓ and few predators are adapted to predate them.✓ (2)

5.1 Bacteria A,✓ protist B,✓ virus. ✓ (3)
5.2 Virus: influenza, rabies, HIV.✓(any 1)
Bacteria: TB. ✓ (1)
Protist: malaria.✓ (1)
5.3

Product	Made by …
yoghurt	bacteria✓
bread	fungus✓
antibiotic	bacteria✓

Total: 35 marks

Review Copy

Strand 2 Exemplar test memorandum

Learner's Book page 98

1.1D: a chemical reaction in which compounds are broken down into simpler substances ✓ (1)

1.2C: particles moving from a high concentration to a low concentration substances ✓ (1)

1.3A: changing from a gas to a liquid✓ (1)

1.4E: increasing in volume when heated✓ (1)

1.5B: a chemical reaction in which alcohol is produced from starch or sugar✓ (1)

2.1B ✓, has 1 proton (2)

2.2A ✓, has 6 protons (2)

3.12 ✓ (1)

3.21 ✓ (1)

3.3Water (1)

3.4Compound ✓ (1)

3.5Ice ✓ (1)

3.6Steam ✓ (1)

3.7Ice, ✓ water, steam. ✓ (3)

4.1Electrolysis✓ (1)

4.2ZnCl2 (1)

4.3Zn ✓,Cl2✓ (2)

4.4.1Zn ✓,Cl2 (1)

4.4.2ZnCl2 ✓ (1)

4.4.3Cl2 ✓ (1)

4.4.4Cl2✓ (1)

5.1.1Air pump ✓ (1)

5.1.2Pressure gauge✓ (1)

5.2Pressure in a gas is caused by the gas particles bumping/colliding✓ into each other and the walls of the container. ✓ (2)

5.3Increased because the number of air particles inside the tyre has increased which increases the number of collisions between the air particles. ✓ (2)

5.4.1The particles are far apart.✓ (1)

5.4.2The particles are moving very fast. ✓ (1)

5.4.3The forces between the particles are weak. ✓ (1)

Total: 35 marks

Review Copy

Strand 2 Exemplar mid-year exam memorandum

Learner's Book page 98

A molecule is the smallest part of a compound and an atom is the smallest part of an element. The central part of an atom is called the nucleus, which contains positively charged protons and neutrons with no charge. Negatively-charged electrons spin around the nucleus.

1.1 = molecule,✓ 1.2 = atom,✓ 1.3 = nucleus,✓ 1.4 = protons✓, 1.5 = neutrons✓, 1.6 = electrons✓ [6]

2.1 nitrogen = element✓, oxygen = element✓, carbon dioxide = compound✓

2.2 An element consists of one kind of atom only.✓ A compound consists of two or more different kinds of atoms.✓

2.3 A mixture consists of substances that can be separated by physical means.✓ A compound consists of elements that can only be separated by chemical means.✓ [7]

3.1 List the reactants and the products this decomposition chemical reaction:

Reactants	Products
potassium permanganate✓	potassium manganate✓
	manganese dioxide✓
	oxygen✓

Review Copy

3.2. A chemical reaction that breaks down✓ a compound into parts✓.

3.3 element✓

3.4 Use a glowing splint.✓ If it relights, oxygen is present.✓ [9]

4.1 List the solid, liquid and gas in order of:

4.1.1 solid, ✓ liquid,✓ gas

4.1.2 gas,✓ liquid,✓ solid

4.1.3 solid,✓ liquid,✓ gas

4.1.4 gas,✓ liquid,✓ solid

4.2 liquid,✓ gas✓

4.3 condensing✓

4.4 The gas particles collide/bump into each other✓ and against the walls of the container.✓

[13]

[Total marks: 35]

Strand 3 Exemplar exam memorandum

Learner's Book page 159

1.1B✓ (1)
1.2A✓ (1)
1.3A✓ (1)
1.4C✓ (1) (4)
2.1E✓ (1)
2.2D✓ (1)
2.3F✓ (1)
2.4A✓ (1)
2.5C✓ (1) (5)

3.1 1 - ✓, 2 - ✓, 3 - ✓ (3)
3.2bubbles,✓ chlorine gas✓ (2)
3.3reddish brown substance,✓copper✓ (2)
3.4electrolysis,✓ electroplating✓ (2) (9)
4.1 Hypothesis: If more resistors are connected in series in a circuit, the bulbs get dimmer as there is less current. Prediction: The more resistors✓, the dimmer the bulb gets. ✓ (2)
4.2 Independent variable: number of resistors in series✓ Dependent variable: brightness of the bulbs.✓ (2)
4.3 Yes ✓all variables are kept the same except the number of resistors✓ or bulbs✓ (3)
5.1 prism✓ (1)
5.2 refraction✓ (1)
5.3 White light travels in waves✓. When it enters the prism✓ it is split into the different colours ✓which each have a slightly different wavelength.✓ (4)
A black car absorbs more light.✓ The black car absorbs all the different wavelengths of colour and therefore looks black, ✓ whereas a pale yellow car will absorb all the colours✓ except pale yellow, which it reflects. ✓ (4)

Total: 35 marks

Review Copy

Strand 4 Exemplar test memorandum

Learner's Book page 195

1.1 Solar flare (1)
1.2 Spiral (1)

1.3 Reflecting (1)

[3]

2.1 D (2)
2.2 A (2)
2.3 A (2)
2.4 B (2)

[8]

3.1 Greek (1)
3.2 Pluto (1)
3.3 Comets/meteors (1)
3.4 Rings (1)
3.5 Mars and Jupiter (1)
3.6 Sulphuric acid (1)
3.7 Water (1)
3.8 Iron (1)
3.9 Mercury (1)
3.10 Methane (1)

[10]

4.1 Surface temperature increases^, oceans evaporate^, more solar energy makes living conditions more harsh^ (3)
4.2 Earliest life forms were plant-like^, released oxygen^ during photosynthesis^ (3)
4.3 Protection from harmful radiation^, ensures greenhouse effect^ (2)

[8]

5.1 Barred spiral/elliptical/irregular (1)
5.2 Edwin Hubble (1)
5.3 Distances from us to other stars is increasing in all directions (1)
5.4 Southern Cross (1)
5.5 South African Large Telescope (1)
5.6 Reflector (1)

[6]

Review Copy

End-of-year exemplar exam memorandum

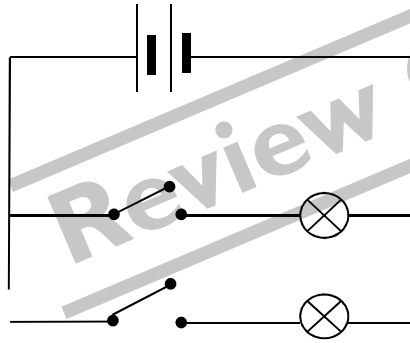
Learner's Book page 197

1.1 Fuse (1)
1.2 Normal (1)

1.3 Refraction (1)
1.4 A light second (1)
1.5 Moon (1)
1.6 Zodiac (1)}
[6]

2.1 A (2)
2.2 B (2)
2.3 C (2)
2.4 B (2)
2.5 B (2)
2.6 C (2)
2.7 B (2)
2.8 C (2)
[16]

3.1



Review Copy

Cell symbol^
Two cells in series^
Light bulb symbol^
Parallel branches each with one light bulb^
Switch symbol^
Switch in each branch^ (6)
3.2 Stays the same (1)
3.3 Current strength stayed the same in each branch (1)
[8]

4.1 Axes labelled and with units^
Linear scale on both axes meeting at (0:0)^

Six plots^^
Best fit curve through points (expect a hyperbola)^
Distance on x-axis, size on y-axis^ (6)

4.2 As the distance of the object from the lamp increases, the size of the shadow decreases (2)

[8]

5.1 Orange, violet, indigo (1)
5.2 Red (1)
5.3 Absorbed (1)
5.4 Transmitted (1)
5.5 Lens focuses light^ to form image on retina^
Certain cone cells can detect green light^
They send a message along the optic nerve to the brain^ (4)

[8]

6.1 Hydrogen (1)
6.2 Heat and light (2)
6.3 Cooler means less radiation, less light (2)

[5]

Review Copy

7.1 Mercury (1)
7.2 The further a planet is from the Sun^, the longer it takes to circle the Sun^ (2)
7.3 Greater radius (distance from Sun)^ means greater circumference (path length of planet around Sun)^ (2)
7.4 The further a planet is from the Sun^, the lower the surface temperature of the planet^ (2)
7.5 Radiation from Sun spreads out as you move away from Sun^, solar energy intensity decreases so lower temperatures^ (2)
7.6 Venus has high percentage carbon dioxide^ in atmosphere, so increased greenhouse effect^, so temperature higher than expected^ (3)

[12]

8.1 Ice caps (1)
8.2 B → F → A → E → C → D (one mark per correct pair, even if other steps inbetween) (5)
8.3 During evaporation (1)

[7]

TOTAL MARKS **70**

Review Copy