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Successful

Natural Sciences

TEACHER'S GUIDE

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Review Copy

GRADE

9

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 9: 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.

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.

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:

- cells as the basic units of life
- systems in the human body
- human reproduction
- circulatory and respiratory systems
- digestive system
- compounds
- chemical reactions
- reactions of metals with oxygen
- reactions of non-metals with oxygen

- acids, bases, and pH value
- reactions of acids with bases: Part I
- reactions of acids with bases: Part II
- reactions of acids with bases: Part III
- reactions of acids with metals
- forces
- electric cells as energy systems
- resistance
- series and parallel circuits
- safety with electricity
- energy and the national electricity grid
- cost of electrical power
- the Earth as a system
- lithosphere
- mining of mineral resources
- atmosphere
- birth, life and death of stars

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

This table shows that the teaching time for Natural Sciences is allocated 3 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 9. These topics are organised into 7 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 Grade 7, 8 and 9:

TERM	GRADE 7		GRADE 8		GRADE 9	
	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	Properties of materials	2	Atoms	2	Compounds	1
			Particle model of	5	Chemical	1

Sciences: Matter and materials	Separating mixtures	2	matter		reactions	
	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
					Reactions of acids with bases: Part III	0,5
					Reactions of acids with metals	0,5
		(8 weeks)		(8 weeks)		(8 weeks)
Term 3 Natural Sciences: Energy and Change	Sources of energy	1	Static electricity	1	Forces	2
	Potential and kinetic energy	2	Energy transfer in electrical systems	3	Electric cells as energy systems	0,5
	Heat transfer	2	Series and parallel circuits	2	Resistance	1
	Insulation and energy saving	2	Visible light	3	Series and parallel circuits	2
	Energy transfer to surroundings	1			Safety with electricity	0,5
	The national electricity supply system	1			Energy and the national electricity grid	1
		(9 weeks)		(9 weeks)	Cost of electrical power	2
						(9 weeks)
Term 4 Natural Sciences: Planet	Relationship of the Sun to the Earth	4	The Solar System	1	The Earth as a system	1
			Beyond the	3	Lithosphere	2

Earth and beyond	Relationship of the Moon to the Earth	2	Solar System Looking into space	2	Mining of mineral resources	2
	Historical development of astronomy	2			Atmosphere	2
		(8 weeks)			Birth, life and death of stars	1
				(8 weeks)		(8 weeks)

Teaching plan for Natural Sciences Grade 9

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	Cells as basic units of life: Cell structure	12	32	
1	1	Unit 2	Cells as basic units of life: Difference between plants and animal cells	15	33	
2	1	Unit 3	Cells as basic units of life: Cells in tissues, organs and systems	18	37	
3	1	Unit 4	Systems in the human body: Body systems: Digestive system	25	42	
3	1	Unit 5	Systems in the human body: Body systems: Circulatory and respiratory systems	29	44	
4	1	Unit 6	Systems in the human body: Body systems: Musculoskeletal, excretory	33	47	

Term 1						
Week	Strand	Unit	Contents	LB pages	TG pages	Formal assessment
			and nervous systems			
4	1	Unit 7	Systems in the human body: Body systems: Reproductive systems	38	49	
5	1	Unit 8	Human reproduction: Purpose of reproduction	40	49	
6	1	Unit 9	Human reproduction: Reproductive organs	42	51	
7	1	Unit 10	Digestive system: The alimentary canal and digestion	44	53	
7	1	Unit 11	Circulatory and respiratory systems: Breathing, gaseous exchange and reproduction	48	56	
8	1	Unit 12	Circulatory and respiratory systems: Circulation and respiration	52	58	✓
8	1	Unit 13	Digestive system: Healthy diet	58	64	
9	1	Unit 14	Digestive system: The alimentary canal and digestion	63	68	✓
9	Revision assessment		Strand 1 Exemplar test	67	185	✓

Term 2						
Week	Strand	Unit	Contents	LB pages	TG pages	Formal assessment
1	2	Unit 1	Compounds: The Periodic Table	70	74	
1	2	Unit 2	Compounds: Names of compounds	73	75	
2	2	Unit 3	Chemical reactions:	76	79	

Term 2						
Week	Strand	Unit	Contents	LB pages	TG pages	Formal assessment
			Chemical equations to represent reactions			
2	2	Unit 4	Chemical reactions: Balanced equations	78	80	
3	2	Unit 5	Reactions of metals with oxygen: The general reaction of metals with oxygen	80	82	
4	2	Unit 6	Reactions of non-metals with oxygen: The general reaction of non-metals with oxygen	86	87	
5	2	Unit 7	Acids, bases and pH value: Universal indicator: The concept of pH value	88	88	✓
5	22	Unit 8	Reaction of acids with bases: Neutralisation and pH	92	90	
6	2	Unit 9	Reaction of acids with bases: The general reaction of an acid with metal oxide (base)	94	92	
7	2	Unit 10	Reaction of acids with bases: The general reaction of an acid with a metal hydroxide (base)	98	95	✓
8	2	Unit 11	Reaction of acids with bases: The general reaction of an acid with a metal carbonate (base)	100	97	
8	2	Unit 12	Reaction of acids with bases: The general reaction of acids with metals	102	99	
8	Revision assessment		Strand 2 Exemplar test	105	186	✓
	Revision		Strand 2 Exemplar mid-year	107	187	✓

Term 2						
Week	Strand	Unit	Contents	LB pages	TG pages	Formal assessment
	assessment		exam (Term 1 and 2)			

Term 3						
Week	Strand	Unit	Contents	LB pages	TG pages	Formal assessment
1	3	Unit 1	Forces: Types of forces	110	105	
1	3	Unit 2	Forces: Field forces – gravitational force	115	107	
2	3	Unit 3	Forces: Field force – magnetic force	118	110	✓
2	3	Unit 4	Forces: Field force – electrostatic force	123	114	
3	3	Unit 5	Electric cells as energy systems: Electric cells	126	116	✓
3–4	3	Unit 6	Resistance: Uses of resistance	128	120	
4	3	Unit 7	Resistance: Factors that affect resistance	130	120	✓
5	3	Unit 8	Series and parallel circuits: Series circuits	134	126	
5	3	Unit 9	Series and parallel circuits: Parallel circuits	140	132	
6	3	Unit 10	Series and parallel circuits: Parallel circuits in the home	144	137	
6	3	Unit 11	Safety with electricity: Safety practices	148	140	
7	3	Unit 12	Energy and the national electricity grid: Electricity	154	143	

Term 3						
Week	Strand	Unit	Contents	LB pages	TG pages	Formal assessment
			generation			
7	3	Unit 13	Energy and the national electricity grid: Nuclear power in South Africa	156	145	
8	3	Unit 14	Energy and the national electricity grid: The national electricity grid	158	145	
8–9	3	Unit 15	Cost of electrical power: The cost of power consumption	160	146	
9	Revision assessment		Strand 3 Exemplar test	165	189	✓

Term 4						
Week	Strand	Unit	Contents	LB pages	TG pages	Formal assessment
1	4	Unit 1	The Earth as a system: Spheres of the Earth	168	151	
2	4	Unit 2	Lithosphere: Lithosphere	171	154	✓
3	4	Unit 3	Lithosphere: The rock cycle	174	157	
4	4	Unit 4	Mining of mineral resources: Extracting ores	182	162	
4–5	4	Unit 5	Mining of mineral resources: Refining minerals	184	163	
5	4	Unit 6	Mining of mineral resources: Mining in South Africa	188	167	
6	4	Unit 7	Atmosphere: The Earth's atmosphere	192	170	
6	4	Unit 8	Atmosphere: The troposphere	194	172	✓
6	4	Unit 9	Atmosphere: The stratosphere	196	174	

Term 4						
Week	Strand	Unit	Contents	LB pages	TG pages	Formal assessment
7	4	Unit 10	Atmosphere: The mesosphere	198	175	
7	4	Unit 11	Atmosphere: The thermosphere	199	175	
7	4	Unit 12	Atmosphere: The greenhouse effect	200	176	✓
8	4	Unit 13	Birth, life and death of stars: The birth of a star	204	180	
8	4	Unit 14	Birth, life and death of stars: Life and death of a star	206	181	✓
9	Revision assessment		Strand 4 Exemplar test	211	192	✓
	Revision assessment		Strand 4 Exemplar end-of-year exam (Term 3 and 4)	213	193	✓

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.

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.

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

GRADE 9 (Example based on minimum prescribed marks)

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

Formal assessment tasks in Natural Sciences Grade 9			
Strand	Tasks	Options	Page
1 Life and living	Practical task	Measure and compare heart rates before and after exercise	56
	Project	Make a model digestive system	66
	Exemplar test	Content Term 1	67
2 Matter and materials	Practical task	Investigate a selection of household substances using indicators	90
		Investigate neutralisation of a metal hydroxides by reacting dilute sodium hydroxide (NaOH) with dilute hydrochloric acid (HCl)	92

	Project	Find out more about electroplating, iron ore mining or steel production	85
	Exemplar test	Content Term 2	105
	Exemplar mid-year exam	Content Term 1 and 2	107
3 Energy and change	Practical task	Investigate the effect of different thickness of materials on resistance	133
	Project	Plan an investigation to get the highest voltage	163
		Investigate the effect of connecting more cells in series	135
	Exemplar test	Content Term 3	165
4 Planet earth and beyond	Practical task	Make a model of the greenhouse effect	200
	Project	Investigate how South Africa contributes to global warming	210
	Control test	Content Term 4	211
	Exemplar end-of-year exam	Content Terms 3 and 4	213

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.

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, analysing, synthesising scientific Knowledge
Percentages indicating the proportion of low, middle and high order questions in tasks, tests and exams	Low order questions 40%	Middle order questions 45%		High order questions 15%
Useful verbs to use when setting questions	State Name Label List 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.

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.

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.

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

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.

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.

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?

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 in 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':

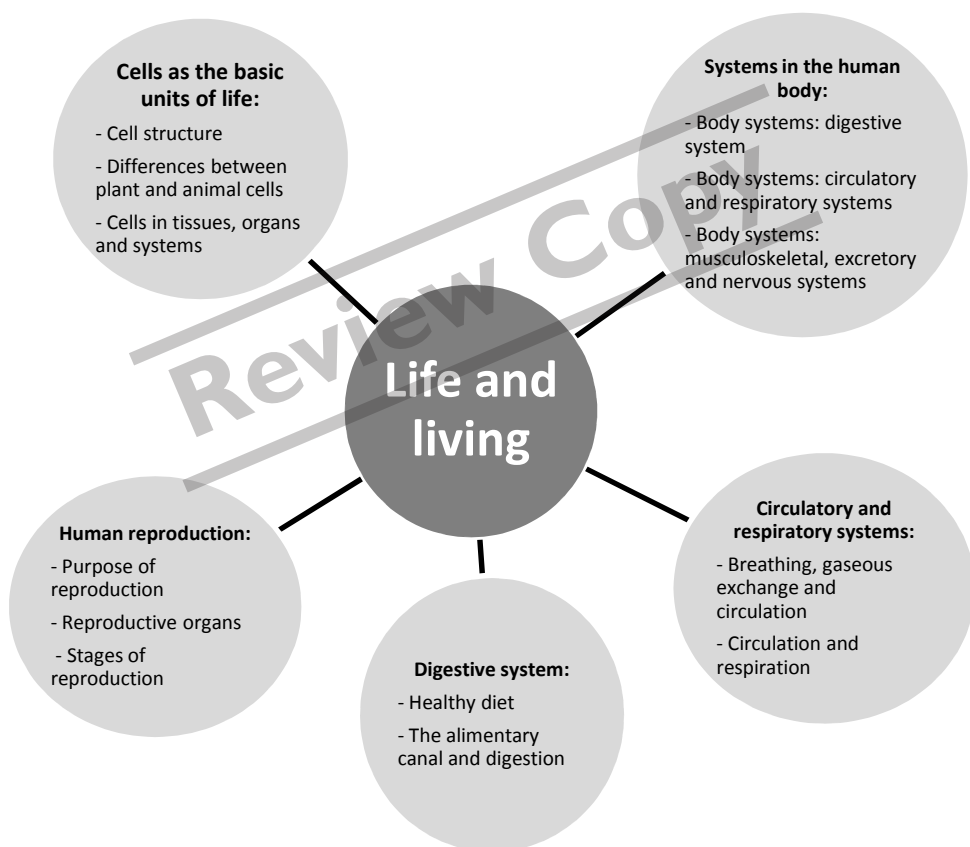
1. Choose a short piece of text and note where you will stop during reading to model your thought processes.
2. Things to include in this planning stage could be:
 - reading the text title and the table of contents
 - looking at the images and predicting what the text may be about
 - skim-reading the 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.

Strand 1

Life and living

Core concepts covered



Strand overview

In this strand, learners are introduced to cells which are the basic units of life. They will examine cell structure and look at the differences between plant and animal cells

as well as cells found in different tissues, organs and systems. They will then learn about systems in the human body including the digestive, circulatory, respiratory, musculoskeletal, excretory, nervous and reproductive systems. Learners will then explore human reproduction in more depth, looking at the purpose of reproduction, puberty, reproductive organs and different stages of reproduction. This strand also introduces human circulatory and respiratory systems and describes breathing, gaseous exchange, circulation and respiration. Learners will also explore some aspects of the human digestive system and learn about the alimentary canal and digestion as well as the importance of a healthy diet.

Content

Unit No.	Content	Pacing (Time allocation)	LB page	TG page
1	Cells as the basic units of life: Cell structure	2 hours	12	32
2	Cells as the basic units of life: Differences between plant and animal cells	2 hours	15	33
3	Cells as the basic units of life: Cells in tissues, organs and systems	2 hours	18	37
4	Systems in the human body: Body systems: digestive system	1 hour	25	42
5	Systems in the human body: Body systems: circulatory and respiratory systems	2 hours	29	44
6	Systems in the human body: Body systems: musculoskeletal, excretory and nervous systems	2 hours	33	47
7	Systems in the human body: Body systems: reproductive system	2 hours	38	49
8	Human reproduction: Purpose of reproduction	2 hours	40	50
9	Human reproduction: Reproductive organs	1 hour	42	51
10	Human reproduction: Stages of reproduction	3 hours	44	53
11	Circulatory and respiratory systems: Breathing, gaseous exchange and circulation	2½ hours	48	56
12	Circulatory and respiratory systems: Circulation and respiration	2 hours	52	58
13	Digestive system: Healthy diet	2 hours	58	64

14	Digestive system: The alimentary canal and digestion	2½ hours	63	68
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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	Measure and compare heart rates before and after exercise	56	61	Suggested answers (20)	61
Project	Make a model digestive system	69	69	Rubric (50)	70
Controlled test	Exemplar test	167	185	Memorandum (40)	185

Review Copy

Unit 1 Cells as the basic units of life: Cell structure

Learner's Book pages 12–14

Unit overview

This unit describes what cells are and introduces various common structures that are found in cells.

Resources

- Micrographs of various kinds of cells
- library.thinkquest.org/3564/gallery.html

Teaching guidelines

Discuss the pictures of different cells in the Learner's Book on page 12 with the class and ask them to name the structures that they have already learnt about in this unit.

Background knowledge

Cells are the building blocks of all living things. There are some fundamental differences between plant and animal cells which make up most of the living things. There are some exceptions, although these are specialised cells and have specific purposes.

TIP!

Have a diagram of a cell on the classroom wall and refer to this regularly.

Activity 1

Draw, label and describe the structure of an animal cell

Learner's Book page 14

Guidelines to implement this activity

- This is an individual activity.
- Discuss the pictures of different cells in the Learner's Book on page 12 with the class and ask them to name the structures that they have already learnt about in this unit.

Suggested answers

- 2 Diagram/drawing of human cheek cells
Labels: nucleus✓, cytoplasm✓, cell membrane✓ (3)
- 3 Heading included ✓ (1)

- 4.1 Cells do not have a regular shape but are sort of oval✓, they are close together ✓ (2)
- 4.2 A dark dot in the cell.✓ (1)
- [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 7 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Re-draw a simplified diagram of a cheek cell on the board and ask learners to help you label it.

Extension/Extension activity

Give learners a micrograph of a different type of cell and ask them to identify the different cell structures.

Unit 2

Cells as the basic units of life: Differences between plant and animal cells

Learner's Book pages 15–17

Unit overview

In this unit, the class will learn about the structure of plant cells and how they differ from animal cells.

Resources

- www.sciencekids.co.nz/videos/biology.html
- www.goldiesroom.org/video_archive.htm
- www.rkm.com.au/cell/animalcell.html
- three plastic 2-litre cooldrink bottles per pair of learners, scissors, large clear plastic bags, gelatin, teaspoons, warm water, small clear plastic sandwich bags or coloured balloons, cold water, ping pong balls or balls of tin foil, plasticine in different colours, ink or food colouring.

Teaching guidelines

Ask learners how they think plant cells may differ from animal cells.

Background knowledge

It is important to emphasise that the most important difference between plant and animal cells is that plant cells have a cell wall. However, you need to make the point that plant cells also have chloroplasts and vacuoles, which animal cells generally do not, although some animal cells do have temporary vacuoles.

Activity 1

Draw, label and describe the structure of a plant cell

Learner's Book page 16

Guidelines to implement this activity

- This is an individual activity.
- Ask the learners to re-read the information given in this unit and then carry out this activity.

Suggested answers

- 2 Diagram of a plant cells, heading✓ (1)
Labels: cell wall✓, vacuole✓, chloroplast✓, nucleus✓, cytoplasm✓, cell membrane✓ (6)
 - 3 Rectangular✓ (1)
 - 4 Closely packed – cell wall makes them more geometric so they fit together like bricks✓ (1)
- [8]

Total: 8 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 8 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Re-draw a simplified diagram of a plant cell on the board and ask learners to help you label it.

Activity 2**Identify and explain the main differences between plant and animal cells**

Learner's Book page 16

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to compare the two diagrams they drew for Activity 1 in Unit 1 and Activity 1 in Unit 2.
- Write down the differences they observe on the board. Then ask them to carry out this activity using this information.

Suggested answers

1

Cell feature	Plant cell	Animal cell
Cell membrane✓	has a cell membrane✓	has a cell membrane✓
Nucleus✓	has a nucleus✓	has a nucleus✓
Cytoplasm✓	has cytoplasm✓	has cytoplasm✓
Vacuole✓	large vacuole✓	small vacuole✓
Cell wall✓	has a cell wall✓	no cell wall✓
Chloroplasts✓	has chloroplasts✓	no chloroplasts✓
Mitochondria✓	has mitochondria✓	has mitochondria✓

(21)

2.1 Plant✓

(1)

2.2 Cell has cell wall,✓ large vacuole,✓ chloroplasts✓

(3)

2.3 1 = chloroplast✓: makes food by photosynthesis✓; 2 = cell wall✓: gives cell contents protection, shape and support✓

(4)

Total: 29 marks**Assessment guidelines**

- This activity is intended for informal assessment.
- Ask learners to swap their notebooks with a partner and mark their tables. Use the suggested answers supplied above. Ask them to allocate learners a mark out of 29 to prepare them for formal assessment.

Remediation/Remedial activity

Recap the differences between the two types of cells by going over the table on the board.

Practical activity 3

Make a model cell

Learner's Book page 1

Guidelines to implement this activity

- This is a pair activity.
- Read through the method of this activity to make sure all learners understand what they have to do.
- Demonstrate how to cut a cooldrink bottle so that learners can see how to do it. Warn learners to be careful that they do not cut themselves.
- While learners are making their model, make sure that they dissolve their gelatine completely and that the knots in the bags/balloons are secure.
- Ask the learners to answer the questions to this activity in their notebooks.

Suggested answers

1. cooldrink bottles represent the cell wall ✓ (1)
 - 2.1 Cell membrane ✓ (1)
 - 2.2 Controls substances entering and leaving the cell ✓ (1)
 - 3.1 Cytoplasm ✓ (1)
 - 3.2 It is jelly-like ✓ (1)
 - 3.3 Because it is quite liquid and fills up the space it is in. ✓ In a real cell the cytoplasm pushes against the cell membrane. ✓ (2)
 - 4.1 With a small plastic bag or balloon. ✓ (1)
 - 4.2 Plant cell vacuoles are much bigger than vacuoles in animal cells. ✓ (1)
 - 5.1 The nucleus ✓ (1)
 - 5.2 The nucleus controls the cell's activities. ✓ It also contains information the cell needs to reproduce itself. ✓ (2)
 - 6.1 Own answer ✓ (1)
 - 6.2 The best colour is green as chloroplasts contain green chlorophyll. ✓ (1)
 - 6.3 They make food for the cell. ✓ (1)
 - 7 A plant cell ✓ It has a cell wall (the cooldrink bottle), ✓ large vacuole (plastic bag/balloon), ✓ and chloroplast (plasticine). ✓ (4)
- [19]

Total: 19 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Ask learners to display their cell models in the front of the class. Use the suggested answers supplied above to assess learners informally. Go through the answers to the questions orally in the class. Ask learners to mark their own work out of 19.

Unit 3

Cells as the basic units of life: Cells in tissues, organs and systems

Learner's Book pages 18–24

Unit overview

In this unit, learners will be introduced to the use of the microscope. They will learn how cells of the same type form tissues and how organs form systems that then make up organisms. They will also learn about stem cells and their uses.

Resources

Student microscope/s, slides and coverslips, iodine stain, onions, beakers of water, tissue paper, mounted needle, cotton buds, micrographs of muscle tissue, figures of muscle tissue

- Photos of different types of tissue:
www.ptei.org/interior.php?pageID=42
- Microscope:
youtube.com/watch?v=PSXA_xxndkA
- Cheek cells photo:
lab.en.mbtnua.com/2011/12/general-science-cells-up-close-and.html
- Stem cell research cartoon:
www.youtube.com/watch?v=tPulEAryPO0

Teaching guidelines

Ask learners whether they think they can see individual cells with the naked eye.

Background knowledge

Individual cells can be seen with the naked eye in the form of cells in orange segments which range in size from one millimetre and less. Onion skin cells are used in many

practical activities because they are also fairly large. However, cells can also be as small as one to two micrometres in diameter such as is the case with many bacteria.

Activity 1	Research and write about the history of the discovery of microscopes	Learner's Book page 19
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Guidelines to implement this activity

- This is an individual activity.
- Read through the instructions of the activity with the class.
- Take the class to the library so they can look up the required information on microscopes in either books or on the Internet. Ask them to read through the information in the Learner's Book as well.

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):			
followed the instructions in the Learner's Book and understood what to do			
included information about how a light microscope works			
included information about the discovery of light microscopes including dates and names			
included information about the invention of the electron microscope and how it works			
described how the discovery of microscopes has been useful to people			
produced a written piece of work showing ability to compile facts in a logical format.			

Activity 2	Tabulate the functions of the parts of the light microscope	Learner's Book page 19
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Guidelines to implement this activity

- This is an individual activity.
- Ask learners to re-read the section in the Learner's Book on microscopes and then copy and complete the table in their notebooks.

Suggested answers

1

Structure	Function
1 Eye piece	Lens which magnifies the object
2 Tube	Supports the eyepiece and connects it to the objective lenses
3 Coarse focus	Used for focusing on low power
4 Fine focus	Used to fine focus the specimen after the coarse focus is used
5 Objective lens	Magnifies the specimen
6 Arm	Used to carry the microscope, supports body tube and lenses
7 Stage	Supports the slide
8 Diaphragm	Controls the amount of light on the specimen
9 Condenser	Controls the quality of light
10 Mirror or lamp	Lights the specimen so that it can be seen
11 Base	Supports the microscope

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Go through the answers with the class and ask learners to mark their own work.

Remediation/Remedial activity

Give learners a photocopy of a diagram of a light microscope which does not have the labels on it. Ask learners to label and annotate the diagram.

Practical activity 3 Prepare and examine slides of onion cells

Learner's Book page 20

Guidelines to implement this activity

- This is a pair or group activity (four learners per group).
- Read through the aim and methods of this activity with the class.
- You may have to demonstrate to the learners what part of the onion skin needs to be peeled off for looking at.
- Emphasise that only one or two drops of iodine is required for making the slide.
- Once learners have prepared their slides, give a demonstration on the procedure for operating the microscope as it is very frustrating for learners if they cannot focus on the cells.

Background knowledge

It is much easier to peel off the inner surface of the onion leaf if you use fresh onions.

Suggested answers

Labelled drawing (cell membrane, ✓ nucleus, ✓ cytoplasm ✓) of at least three onion cells with heading ✓ and magnification ✓. [5]

Total: 5 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Ask learners to swap books and mark each other's work, allocating learners a mark out of 5.

Remediation/Remedial activity

Revise the answers on the board.

Extension/Extension activity

If learners have time, ask them to look at some other kind of fruit tissue like an orange.

Practical activity 4

Prepare and examine slides of cheek cells

Learner's Book page 21

Guidelines to implement this activity

- This can be a pair or group activity (four learners per group).
- Read through the method of this activity with the class and divide them into groups if this is going to be a group activity.
- Tell the learners that this activity is a repeat of the previous one, except that a different sample is being investigated.
- It is important to emphasise that all cotton buds must be discarded in the dustbin once the slide has been made.

Suggested answers

Labelled drawing (cell membrane, ✓ nucleus, ✓ cytoplasm ✓) of at least three cheek cells with heading ✓ and magnification ✓. [5]

Total: 5 marks

Assessment guidelines

- This activity is intended for informal assessment.

- Use the memorandum supplied above to assess learners informally. Ask learners to allocate marks out of 5 and compare these results with Practical activity 3.

Remediation/Remedial activity

Ask learners who have managed to complete this activity easily to help those who are struggling.

Extension/Extension activity

Encourage learners to look at other samples of tissue under the microscope and compare their observations with what they have already seen.

Activity 5 Draw and label cells from tissues

Learner's Book page 23

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to examine the individual cells shown in the figure and draw three or four cells of the tissue in their notebooks with labels and a heading.
- Give them a clue about labels by asking them to identify whether it is a plant cell or an animal cell.

Background knowledge

Remind the learners that all cells have the same structure so that even though they may look different to what they have seen, the muscle tissue micrographs still depict animal cells which have the same features.

Suggested answers

- 2 Labelled drawing (cell membrane,✓ nucleus,✓ cytoplasm✓) with heading (smooth muscle tissue)✓

[4]

Total: 4 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 4 and give them feedback on their performance to prepare them for formal assessment.

Activity 6**Research, discuss and write about stem cell research**

Learner's Book page 24

Guidelines to implement this activity

- This is a group activity (four to five learners per group). Ask the group to nominate a spokesperson for the group.
- Take the learners to the library so they can research stem cell research in books or on the internet.
- Set aside a time for the groups to discuss what they have found out, how they feel about it and whether they support it. Remind the spokesperson to take notes so that he/she can report the results of their discussion to the class.

Assessment guidelines

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

Criteria	Yes	Partly	No
The learner(s):			
researched stem cell research adequately			
gave their point(s) of view on stem cell research giving adequate reasons			
concluded whether they support or do not support stem cell research.			

Unit 4**Systems in the human body: Body systems: digestive system**

Learner's Book pages 25-28

Unit overview

In this unit, learners will explore the roles of the different systems in the human body. They will learn about the main processes and components of the digestive system as well as health issues related to the digestive system.

Resources

- Newspaper, coloured pens or kokis, sticky tape
- Digestive system:
www.youtube.com/watch?v=8pI7yKs3w7s

Teaching guidelines

- Ask learners what kind of systems the body needs to keep going.

TIP!

List the eight different body systems of the human body on the board.

Practical activity 1

Draw an outline of the human body

Learner's Book page 27

Guidelines to implement this activity

- This is a pair or group activity (four learners per group).
- Read through the method of this activity so that all learners understand what to do.

Background knowledge

Have a copy of the different body systems available so that you can show the learners.

Assessment guidelines

- This activity is intended for informal assessment.
- Ask the learners to display their newspaper figures and compare where they have placed the digestive organ. Check that all groups have positioned and labelled the organs correctly.

Remediation/Remedial activity

Refer learners who are struggling to look at Figure 2 in Unit 4 of the Learner's Book and revise the names of the digestive system labels.

Activity 2

Research and write about health issues of the digestive system

Learner's Book page 28

Guidelines to implement this activity

- This is an individual activity.
- Refer to the four diseases covered in this unit.
- Ask learners to choose which one they would like to research and write about.
- Take them to the library where they can look for more information in books or on the internet on the disease they have chosen to write about.

Background knowledge

Diarrhoea is one of the most common health issues, and will be familiar to many learners as they or their siblings may have suffered from it. Liver cirrhosis, anorexia nervosa and ulcers tend to affect older people and may be new to learners.

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):			
included information under 'Name of disease'			
included information under 'Symptoms'			
included information under 'Causes'			
included information under 'Prevention and treatment'			
presented a well written report.			

Remediation/Remedial activity

Ask learners who left information out in their report, to include it in their report.

Extension/Extension activity

Ask learners to find out about other diseases associated with the digestive system and how they affect their health.

Unit 5

Systems in the human body: Body systems: circulatory and respiratory systems

Learner's Book pages 29–32

Unit overview

This unit discusses how the circulatory and respiratory systems work together to supply oxygen to, and remove carbon dioxide from, the body cells. The main components of the circulatory system and processes that take place within it are explored, as well as health issues related to the circulatory system. The main components of the respiratory system, and the processes that take place within it are also discussed, as well as health issues related to the respiratory system.

Resources

- Pictures/photos of plaque in arteries
- www.healthcentral.com/cholesterol/h/removing-plaque-from-arteries-veins.html
- odlarmed.com/?cat=55&paged=2
- smokerslungs.net/normal-lung-vs-smokers-lung

Teaching guidelines

- Ask learners what they understand by the terms circulatory and respiratory.
- Ask whether they know anyone who has suffered from a stroke or heart attack.

Background knowledge

The respiratory and circulatory systems work together – one cannot operate without the other.

Activity 1

Research and write about circulatory disease

Learner's Book page 30

Guidelines to implement this activity

- This is a pair activity.
- Refer to the heart diseases covered in this unit.
- Ask learners to form pairs and go to the library and research at least four different heart diseases.
- Remind them to take notes under the headings of 'Name', 'Cause', 'Symptoms' and 'Treatment and prevention'.

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):			
researched four or more heart diseases			
presented their findings under the four headings listed in the activity			
made a poster which was eye-catching			
Included a slogan warning people about heart disease.			

Remediation/Remedial activity

Make a table on the board of all the different heart diseases that have been researched, their causes and treatment and prevention.

Activity 2

Research and write about respiratory disease

Learner's Book page 32

Guidelines to implement this activity

- This is a pair activity.
- Ask learners to form pairs and go to the library and research at least four different respiratory diseases.
- Remind them to take notes under the headings of 'Name', 'Cause', 'Symptoms' and 'Treatment and prevention'.

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):			
researched at least four respiratory diseases			
used the four headings listed in the activity			
wrote an informative paragraph about the selected respiratory disease.			

Remediation/Remedial activity

Make a table on the board of all the different respiratory diseases that have been researched, their causes and treatment and prevention.

Extension/Extension activity

Ask learners to find out if anyone in their family has suffered from a respiratory disease and determine what the symptoms were and how it was treated.

Unit 6 Systems in the human body: Body systems: musculoskeletal, excretory and nervous systems

Learner's Book pages 33-37

Unit overview

This unit explains how the skeleton and muscles work to support and bring about movement in the body. The main parts of the musculoskeletal, excretory and nervous systems are explored as well as the processes that take place in them. In addition, some health issues related to the musculoskeletal, excretory and nervous systems are described.

Resources

- Plastic skeleton model, charts showing diagrams of the skeleton
- www.kidsknowit.com/free-educational-posters/free-health-posters.php
- www.bbc.co.uk/learningzone/clips/the-animal-skeleton/2302.html
- science.pppst.com/humanbody/skeletons.html

Teaching guidelines

- Ask learners to feel their various bones and name them.
- Have an unlabelled diagram of a skeleton on the board and add the names as they are suggested.

Activity 1 Research and write about musculoskeletal diseases

Learner's Book page 34

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to select one of the musculoskeletal diseases mentioned in this unit or any other disease of the system that they may know of.
- Ask them to bring information from home or go to the library and find out as much as they can about their selected disease.
- Remind them to include information on the causes, symptoms and treatment of the disease they have selected.

Background knowledge

Cases of rickets are fairly numerous in the underdeveloped world. Although it is mainly older people who suffer from arthritis, some children can also have it. Osteoporosis is particularly common in older females.

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):			
selected a respiratory disease			
included information on the causes, symptoms and treatment of the disease			
wrote an informative paragraph about this disease.			

Activity 2

Research and write about excretory and nervous system diseases

Learner's Book page 37

Guidelines to implement this activity

- This is an individual, pair or group activity.
- Ask learners to use the internet and books to find out about one disease of the excretory system and one disease of the nervous system.
- If the learners work in pair or groups, split the researching between them.

Assessment guidelines

- This activity is intended for informal assessment.
- Ask the learners to read their paragraphs out to the class and encourage a class discussion on the diseases presented.

Remediation/Remedial activity

Make a table on the board of all the different diseases researched and summarise their causes, treatment and prevention.

Unit 7 Systems in the human body: Body systems: reproductive system

Learner's Book pages 38–39

Unit overview

In this unit, the purpose of human reproduction will be discussed. The main processes and organs involved in reproduction will be explored and some health issues that affect the reproductive system are presented.

Resources

- www.bbc.co.uk/schools/gcsebitesize/science/edexcel_pre_2011/genes/reproductionandcloningrev1.shtml
- Poster sheets for making posters
- Pamphlets from health clinics about sexually transmitted diseases, foetal alcohol syndrome and infertility.

Teaching guidelines

Ask learners to read over the definitions used in human reproduction and explain any they do not understand.

Background knowledge

Learners will need to get used to the terminology for human reproduction as there is a great deal of it. Revise words often.

Activity 1 Produce a poster about healthy life style choices

Learner's Book page 39

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Recap the reproductive health issues covered in this unit and ask groups to choose one that they would like to learn more about.
- Ask each member of the group to collect information about this topic from books and/the internet.
- Provide them with poster paper and ask them to design and make a poster encouraging people to adopt a healthy life.

- Remind them that for the poster to be effective, it must be made to attract peoples' attention.
- People are always affected by images that tell the truth.

Background knowledge

An effective poster is one that attracts peoples' attention, and images that tell the truth often hit the hardest. Remind learners of this when they make their posters.

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):			
provided sufficient information for the poster			
produced a poster which drew attention			
presented a slogan encouraging people to adopt a healthy life style.			

Remediation/Remedial activity

Hang the posters up in the classroom and encourage learners to read the information presented on each other's posters.

Unit 8 Human reproduction: Purpose of reproduction

Learner's Book pages 40–41

Unit overview

This unit explains why reproduction is necessary. It also discusses the changes that take place during puberty caused by various hormones as well as secondary sexual characteristics.

Resources

- Health pamphlets from clinic
- en.wikipedia.org/wiki/Kallmann_syndrome

Teaching guidelines

- Ask learners what they think the purpose of reproduction is
- Ask them to think about how their bodies have changed since Grade 1.

TIP!

Draw a flow diagram to indicate the processes of puberty in males and females.

Activity 1**Compare secondary sexual characteristics in males and females**

Learner's Book page 41

Guidelines to implement this activity

- This is an individual activity.
- Recap what the definition of secondary sexual characteristic is and ask learners to complete the table in this activity using the information given in this unit.

Suggested answers

Males	Females
Sex hormone is testosterone✓	Sex hormone is oestrogen✓
Sex organs develop✓	Sex organs develop✓
Rapid body growth ✓	Rapid body growth✓
Voice deepens✓	Breasts form✓
Pubic hair grows✓	Pubic hair grows✓
Facial hair grows✓	Hips widen✓
	Menstruation starts✓

Assessment guidelines

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

Unit 9 Human reproduction: Reproductive organs

Learner's Book pages 42-43

Unit overview

In this unit learners will learn about the structure and functions of the male and female reproductive organs.

Resources

- Charts of male and female reproductive organs
- www.neok12.com/Reproductive-System.htm

Teaching guidelines

Show the learners charts of the male and female reproductive organs and refer to them regularly when following this unit.

TIP!

Read the labels on diagrams out loud to the class so they know how to pronounce the words correctly.

Background knowledge

This unit is mainly about remembering the names of the different parts of the reproductive organs which can be quite difficult. Repeat names regularly so that learners get used to the terminology.

Activity 1

Label and explain processes in the male reproductive organs

Learner's Book page 43

Guidelines to implement this activity

- This is an individual, pair or group activity (three learners per group).
- Ask learners to study the figure and answer the questions in their s.
- Pairs or groups should discuss the answers first before writing them down.

Suggested answers

- 1 sperm duct,✓ 2 penis,✓ 3 urethra,✓ 4 scrotum,✓ 5 testes✓ (5)
- 2 Carries sperm from testes ✓ (1)
- 3 Transfers sperm into the female's body ✓ (1)
- 4 Testosterone✓ (1)
- 5 Testes -> sperm duct -> urethra -> penis✓ (1)
- 6 Maturation✓ the sex organs make sperm cells. ✓ (1)
Copulation ✓the process where the penis is placed in the vagina ✓
Ejaculation✓ is the release of sperm from the penis by contractions of the muscle lining the sperm tube and urethra.✓ (6)

[15]

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.

Remediation/Remedial activity

Revise the answers to the activity on the board.

Activity 2

Label and explain processes in the female reproductive organs

Learner's Book page 43

Guidelines to implement this activity

- This is an individual, pair or group activity (three learners per group).
- Ask learners to study the figure and answer the questions in their notebooks.
- Pairs or groups should discuss the answers first before writing them down.

Suggested answers

- 1 1 uterus,✓ 2 ovary,✓ 3 oviduct,✓ 4 vagina✓ (4)
 - 2 Produces ova/egg cells✓ (1)
 - 3 3✓ (1)
 - 4 The hormone oestrogen is released by the ovary.✓ This causes the ova to mature ✓and ovulation✓ to start so that mature ova can be released✓ for fertilisation (4)
- [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

Revise the answers to the activity on the board.

Unit 10 Human reproduction: Stages of reproduction

Learner's Book pages 44-47

Unit overview

This unit describes the different stages that take place during reproduction. It also explains about certain substances that can harm the foetus, methods of preventing pregnancy and some other issues related to reproduction.

Resources

- Charts of the male and female reproductive organs
- Pamphlets from health clinics on prevention of pregnancy and substances that can harm unborn children.

Teaching guidelines

- To introduce the unit, write up some words on the board relating to human reproduction and ask the learners what they mean
- Ask them to read the definitions of various words associated with human reproduction in the introduction of this unit.

Activity 1

Draw a flow diagram of the sequence of stages in reproduction

Learner's Book page 46

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to re-read the information in this unit on sexual reproduction and answer the questions.

Suggested answers

1&2 ovulation → thickening of uterus → menstruation → copulation → ejaculation → fertilisation → implantation → gestation

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Ask learners to call out the stages in the correct sequence and write them on the board so they can check their answers.

Activity 2

Research and write about the effects of alcohol, smoking and drug abuse on the foetus

Learner's Book page 46

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to find out as much information as possible on the effects of alcohol, smoking and drug abuse on the foetus.

- Show them some sample pamphlets from the health clinics which have been produced to give similar kind of information

Background knowledge

Alcohol, smoking and drug substances enter the bloodstream of the mother. The mother's blood is in contact with that of the developing foetus through the umbilical cord. Because the baby is so small and because it is growing and developing, the concentration of toxic substances is much higher than for the mother and the processes involved in development and growth are interfered with. This results in abnormal development of the baby.

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):			
provided information on the physical and mental effects of alcohol on the foetus			
provided information on the physical and mental effects of smoking on the foetus			
provided information on the physical and mental effects of drug abuse on the foetus			
included a warning not to consume alcohol, smoke or take drugs when pregnant.			

Activity 3

Debate and discuss issues related to reproduction

Learner's Book page 47

Guidelines to implement this activity

- This is a group (five learners per group) or class activity.
- Divide the topics up so that each group has a different one to discuss.
- Learners have ten minutes to debate each topic – this means they must be very prepared and therefore advise them to make notes so they do not forget key points.

Assessment guidelines

This activity is intended for informal assessment.

Extension/Extension activity

Encourage further discussion on these topics if time permits.

Unit 11 Circulatory and respiratory systems: Breathing, gaseous exchange and circulation

Learner's Book pages 48-51

Unit overview

This unit introduces the learners to how air enters and leaves the body through breathing as well as how gases are exchanged in the lungs, how oxygenated blood is transported in the blood vessels and diffusion. Learners will also learn about the parts and functions of the circulatory system as well as the structure and functions of arteries, veins and capillaries.

Resources

- www.youtube.com/watch?v=BX2dK0dTslI
- www.youtube.com/watch?v=NTZQL6K4A0E
- www.amazingscienceonline.com/circulatory-system
- www.youtube.com/watch?v=858cJYK2pXU

Teaching guidelines

- Show the learners some video clips of human respiration and circulation.
- Ask them what they think would happen if humans did not have a circulatory system.

Background knowledge

Circulation is the movement of the blood around the human body. Arteries are blood vessels that carry blood away from the heart. Veins are blood vessels that carry blood back to the heart. Many learners confuse respiration with breathing. Breathing is the inhalation and exhalation of air to and from the lungs while respiration is the release of energy from food molecules in body cells, using oxygen.

Activity 1**Label diagrams of the respiratory system**

Learner's Book page 50

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to re-read this unit and answer the questions in the activity.

Suggested answers

- 1 1 trachea, ✓ 2 ring of cartilage, ✓ 3 rib, ✓ 4 lung, ✓ 5 bronchus, ✓ 6 bronchiole, ✓ 7 diaphragm ✓ (7)
 - 2 Muscles between the ribs contract and lift the ribs upwards and outwards ✓ → diaphragm muscle contracts and is flattened ✓ → volume of the chest increases ✓ → pressure in the chest decreases ✓ → air is drawn into the lungs ✓ (5)
- [12]

Total: 12 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 12 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Go through the answers to this activity on the board so that learners who are struggling understand.

Activity 2**Compare the differences between blood vessels**

Learner's Book page 51

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to re-read the unit and fill in the answers in the table.

Suggested answers

Artery	Capillary	Vein
Thick layer of muscle in wall ✓	Thin walls, no muscle ✓	Thin layer of muscle ✓

Carry oxygenated blood except the pulmonary artery✓	Carry oxygenated blood and then deoxygenated blood✓	Carry deoxygenated blood (except the pulmonary veins) ✓
Carry blood away from the heart✓	Carries blood from the heart and towards the heart✓	Carry blood back to the heart✓

[9]

Total: 9 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Ask learners to swap their s with a partner for marking. Read the answers out from the suggested answers supplied above to assess learners informally. Ask them to allocate a mark out of 9.

Remediation/Remedial activity

Ask learners to verbally repeat the differences between arteries, capillaries and veins.

Unit 12 Circulatory and respiratory systems: Circulation and respiration

Learner's Book pages 52-57

Unit overview

This unit explores how the heart works as a double pump. Learners also find out about the structure of the heart and the meaning of the heartbeat and pulse. This is followed by an explanation of how oxygen enters and is used by body cells and how respiration releases energy for the cells to use. The unit ends off by describing the transport and release of carbon dioxide from the body.

Resources

- www.youtube.com/watch?v=SmF-zkTXLVE
- fresh sheep or pig heart and lungs, dissecting scalpel, disposable gloves, dissection tray, paper towel, laboratory coat or old shirt, stop watch, digital watch or wrist watch with a second hand..

Teaching guidelines

Ask learners to hold their breath and see what happens. How do they feel?

TIP!

Ask learners to feel their pulse and ask them what it is.

Background knowledge

Remembering all the names for the circulatory and respiratory systems is very difficult and the only way for learners to remember is for it to be repeated and to have labelled charts up on the classroom wall so they are exposed to the names every day.

Activity 1

Answer questions about the heart

Learner's Book page 53

Guidelines to implement this activity

This is an individual activity.

Suggested answers

- 1.1 The blood in the left-hand side of the heart is oxygenated.✓ The blood in the right-hand side of the heart is de-oxygenated.✓ (2)
- 1.2 The blood in the left-hand side of the heart flows to the lungs✓ where it receives oxygen before flowing back to the heart.✓ (2)
- 2.1 Pulmonary veins✓ and aorta✓ (2)
- 2.2. Pulmonary artery✓ and vena cava✓ (2)
- 2.3 Valves✓ (1)
- 3 Arteries carry blood away from the heart.✓ Veins carry blood towards the heart. ✓ (2)
- 4 When the ventricles contract,✓ the valves close✓ to stop the blood flowing back into the atria.✓ (3)
- 5 The right side✓ of the heart pumps the blood into the lungs✓ where it is oxygenated.✓ The left side✓ of the heart pumps the oxygenated blood to other parts of the body. ✓ (5)

[19]

Total: 19 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 19 and give them feedback on their performance to prepare them for formal assessment.
-

Remediation/Remedial activity

Go over the answers to this activity so that learners understand circulation to and from the heart fully.

Practical activity 2

Dissect a pig or sheep heart and lungs

Learner's Book page 54

Guidelines to implement this activity

- This is a group activity (five learners in a group).
- If it is difficult to acquire many samples of sheep heart and lungs the teacher will have to carry out this practical as a demonstration.
- Ask learners to answer the questions posed in this activity as the dissection is being carried out, and to make notes in their notebooks.

Background knowledge

Some learners may not like to touch the organ tissue but they must answer the questions for this activity. Make sure that all tissue is disposed of appropriately for health and safety reasons.

Suggested answers

- 3 Spongy. Because the tissue is filled with air.
- 4 Floats because the alveoli contain air.
- 7 Broad at the top and narrow and pointed at the lower end. Ventricles are dark red and the atria lighter pinkish red.
- 8 They supply the heart muscle with oxygen and nutrients and remove wastes.
- 11 Lighter pink colour, thin.
- 12 Labelled drawing of the external structure of the heart
- 14 Left ventricle is very thick and muscular and is dark red, the right ventricle is thinner, atria are thin.
- 15 Prevent blood flowing backwards after the ventricles contract.
- 16 Labelled drawing of internal structure of the heart

Assessment guidelines

- This activity is intended for informal assessment.
- Assess learners informally as the practical is carried out. Ask for answers to the questions while the dissection is taking place.
-

Remediation/Remedial activity

Ask a learner to copy their drawing of the internal or external structure of the heart on the board and then test the class by asking for appropriate labels.

Extension/Extension activity

Hold a quick class quiz on everything the class has learnt in this unit.

Practical activity 3 (PoA)

Measure and compare heart rates before and after exercise

Learner's Book page 56

Guidelines to implement this activity

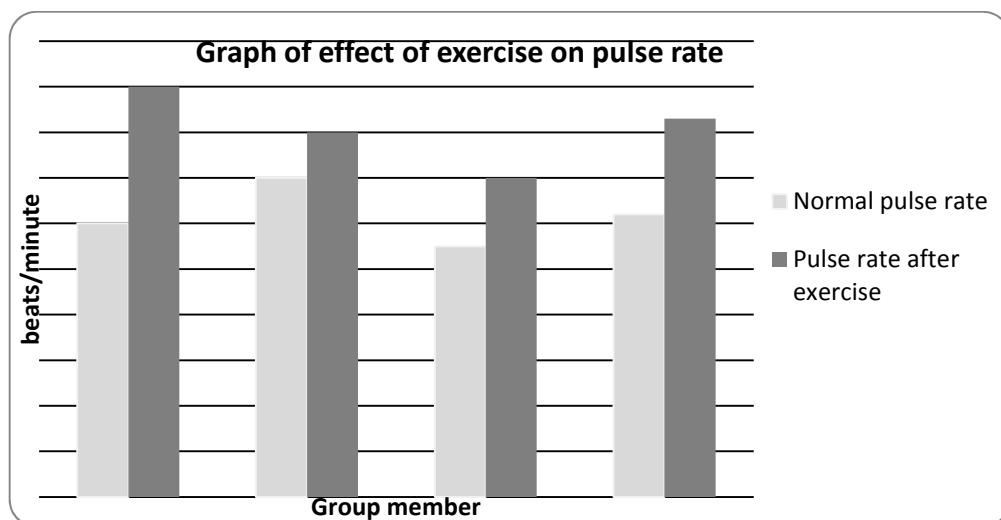
- This is a group activity (four learners per group).
- Make sure that at least one person in each group has a watch or timer for time-keeping.
- Show learners how to measure their pulse.

Suggested answers

- 1 Pulse rate will be higher after exercise ✓ (1)
- 2 Variables are: age, ✓ gender of group members, ✓ amount of exercise they do. ✓
All variables will be kept the same and only one will change. ✓ (4)
- 3 Dependent: number of beats per second. ✓ Independent: physical activity ✓ (2)
7. Table recording of pulse rates with four names and counts ✓

Name	Pulse rate ✓ (beats per minute) ✓
Group member 1	
Group member 2	
Group member 3	
Group member 4	

10. $\frac{1}{2}$ for each name and rate recorded ✓ ✓ (3)
- 11 It is higher ✓ (2)
- 11 It is higher ✓ (1)
- 12 Graph heading. Graph of effect of exercise on pulse rate ✓, correct x and y axes ✓, graph correctly plotted ✓, figure legend ✓ (5)



13 Deductions about fitness, reasons for answer✓

(1)

Conclusion✓

(0)

Exercising makes your heart rate increase, which increases circulation throughout the body.

[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.

Extension/Extension activity

Ask learners to do a different kind of exercise and measure their pulse.

Activity 4

Draw a flow chart of the pathways of oxygen and carbon dioxide

Learner's Book page 57

Guidelines to implement this activity

This is an individual activity.

Background knowledge

Use a chart to demonstrate the pathways of oxygen and carbon dioxide in the human body.

Suggested answers

Oxygen is inhaled → gaseous exchange at the alveoli → enters capillaries by diffusion → carried to left side of heart in arteries → pumped from heart to rest of body → gaseous exchange occurs at the body cells → respiration occurs in mitochondria and energy released → carbon dioxide released as a waste product → Carbon dioxide diffuses into capillaries → Veins return CO₂ to the right side of the heart → right side of heart pumps deoxygenated blood to lungs → at alveoli CO₂ diffuses into lungs and is exhaled

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers/memorandum supplied above for learners to assess their own work. Write out the pathway on the board.

Activity 5

Research and write about one cause of a health issue

Learner's Book page 57

Guidelines to implement this activity

- This is an individual activity.
- Take learners to the library and ask them to research one of the health issues using the Internet or books and taking notes.

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):			
selected a respiratory or circulatory system health issue			
explained and understood what happens to the human respiratory/circulatory system when smoke/alcohol/excessive cholesterol is taken in			
explained and understood why this happens.			

Remediation/Remedial activity

Ask learners who scored 'yes' for all criteria for their report, to read their report to the class.

Unit 13 Digestive system: Healthy diet

Learner's Book pages 58-62

Unit overview

In this unit, the class will learn about food groups and other substances that make up a healthy diet. Learners will also learn how to test for the presence of starch and fat. Learners will explore various disorders of the digestive system related to diet and learn how choices of diet are influenced by culture.

Resources

- 2daypakistan.com/obesity/
- home.messiah.edu/~da1199/health%20problems.html
- arabiangazette.com/billion-children-risk-malnutrition-report/
- pamphlets on obesity from health clinics, iodine solution, dropper, bread, potato, paper, filter paper or paper, cooking oil, butter, white saucer, pictures or wrappers of foodstuffs that are not considered healthy.

Teaching guidelines

- Ask the class to brainstorm what happens if they do not give their bodies the kind of nutrients they need. Write new words on the board.
- Make a list on the board of the important nutrients for humans.

Background knowledge

Show the learners photos of people who have not followed a healthy diet so that its importance makes an impact.

Practical activity 1

Conduct a starch test and a grease test

Learner's Book page 59

Guidelines to implement this activity

- This is an individual, pair or group activity.
- Make sure desks are covered with newspaper and warn learners not to spill the iodine solution as this stains very easily.

Background knowledge

If you cross-test the bread and potato for grease, you may find that the bread also leaves a shiny transparent mark on paper. This is because some breads have quite a bit of fat in them. The potato should not leave a shiny transparent mark however.

Suggested answers

The starch test shows that iodine turns blue-black in the presence of starch. The test for fats and oils is a shiny transparent mark on paper.

Assessment guidelines

- This activity is intended for informal assessment.
- Check that all learners obtained the result they were supposed to see. Help those who did not get the result to repeat the test.

Extension/Extension activity

Ask learners to test the potato and bread for fat, and the cooking oil/butter for starch.

Practical activity 2

Investigate the presence of starch and grease in foods

Learner's Book page 60

Guidelines to implement this activity

- This is a group activity.
- Make sure desks are covered with newspaper and warn learners not to spill the iodine solution as this stains very easily.
- Ask each learners to write up the experiment and results in their notebooks.
- Emphasise that it is important that the method is recorded accurately so that someone else can carry out the practical if they read it.

Suggested answers

- 1 Aim: Determine which foods contain starch and which contain fats and oils. ✓ (1)
- 2 Hypothesis: Foods that contain fats and oils will make a mark on paper causing it to become translucent. ✓ Foods that contain starch will make iodine turn blue-black. ✓ (2)
- 3 Place each of the foods on a white plate or surface. ✓ Add two drops of iodine to each food. ✓ Record your observations. ✓ Rub each sample of food on the piece of white paper and record the observations. ✓ (4)

Food	Starch test: Did the iodine turn blue-black?	Grease test: Did the food make a translucent mark?
Bread	Yes✓	No✓
Potato	Yes✓	No✓
Cheese	No✓	Yes✓
Pasta	Yes✓	No✓
Apple	No✓	No✓
Margarine	No✓	Yes✓
Boiled egg	No✓	No✓
Potato chips	Yes✓	Yes✓
Cooking oil	No✓	Yes✓
Butter	No✓	Yes✓

(20)

- 5 The results support the hypothesis.✓ Some foods contain starch and others contain fats and oils.✓ There are some foods that contain neither starch nor fats and oils.✓ Some foods contain both.✓

(4)

[31]

Total: 31 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 31 and give them feedback on their performance to prepare them for formal assessment.

Activity 3

Discuss unhealthy diets

Learner's Book page 62

Guidelines to implement this activity

- This is a group activity.
- Ask learners to bring wrappers/containers from home from foodstuffs they consider to be unhealthy.
- Ask learners to read through the activity in their groups and discuss the answers.
- Ask them to make notes for a class discussion.

Suggested answers

- 2 Eating processed foods with additives, fatty and sugary foods, not eating a balanced amount of the different foods groups.

- 3 Eat a balanced diet making sure that the correct portions of each food group are eaten. Also be aware that the number of portions can vary for people of different genders, age groups and who are active or not active.

Assessment guidelines

- This activity is intended for informal assessment.
- Have a class discussion to discuss group answers. Use the suggested answers above to assess answers to questions 2 and 3. Make sure that all class members contribute to the class discussion.

Remediation/Remedial activity

Write the list of foods that were suggested to make a diet unhealthy on the board.

Extension/Extension activity

Ask learners to create a healthy diet for their friend in the class.

Activity 4

Compare balanced diets from different cultures

Learner's Book page 62

Guidelines to implement this activity

- This is a pair activity.
- Read through the activity with the class and ask learners to go to the library and look up information on the internet or in books for their report.

Background knowledge

Find out if there are learners in the class from different cultures and ask them to tell the class what kind of food they eat and the reason behind it.

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):			
compared diets from at least two different cultures			
covered all the aspects required for the activity			
wrote a one-page report on their findings			
compiled the report logically.			

Remediation/Remedial activity

Ask learners to read some reports written by other groups in the class.

Extension/Extension activity

Ask learners to look up diets of other cultures they have not researched.

Unit 14 Digestive system: The alimentary canal and digestion

Learner's Book pages 63-64

Unit overview

This unit describes the parts of the alimentary canal. Mechanical digestion and chemical digestion are explained, and learners will find out how the parts of the alimentary canal are suited to their functions.

Resources

- www.youtube.com/watch?v=8pI7yKs3w7s
- kidshealth.org/kid/htbw/Dsmovie.html
- science.nationalgeographic.com/science/health-and-human-body/human-body/digestive-system-article/

Teaching guidelines

- Ask learners to imagine they have eaten something and suggest where it goes from their mouths.
- Have a class discussion on what would happen if humans could not get rid of their waste products.

TIP!

Write a sequence of organs through which food passes from the mouth to the anus and stick it up in the classroom.

Background knowledge

Always ask learners to imagine what is happening in their own body as it is often easier for learners to understand the process if they can relate it to themselves.

Guidelines to implement this activity

- This is an individual, pair or group activity.
- Ask learners to read through the questions in the activity and then study the line diagram of the digestive system. With the help of the information in the Learner's Book, ask them to discuss the answers if the activity is carried out in pairs or a group and write the answers in their notebooks.

Suggested answers

- 1 The stomach produces enzymes to digest proteins. ✓ The large intestine absorbs water. ✓ (2)
- 2 mouth, ✓ oesophagus, ✓ stomach, ✓ small intestine, ✓ large intestine, ✓ rectum ✓ and anus. ✓ (7)
- 3 The small intestines main function is the absorption of food. ✓ It has a thin wall, ✓ a large surface area ✓ and a good blood supply ✓ which allow food to pass easily into the blood stream. (4)

Total: 20 marks

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 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Provide more unlabelled diagrams of the digestive system for learners to label so they can become more familiar with the names of the parts.

Project Make a model digestive system (PoA)

Learner's book page 66

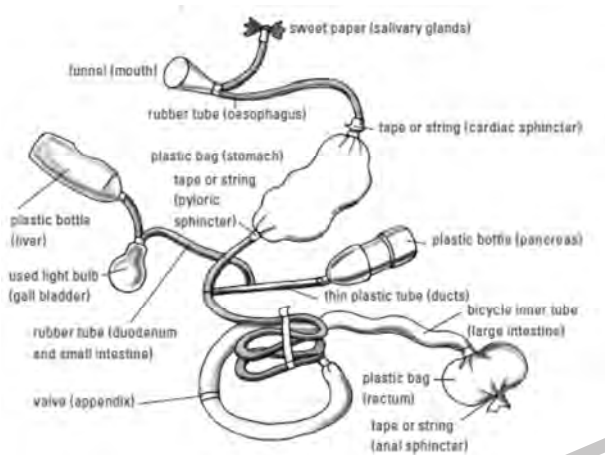
Project: Digestive system

Guidelines to implement this activity

Learners are to work in pairs. Draw a diagram of the digestive system on the board to offer further guidance.

Resources

- sweet paper, funnel, plastic bottles, plastic bags, rubber tubing, bicycle inner tube, thin plastic tube, used light bulb, valve, string, sticky tape.



Assessment guidelines

- This project is intended for formal assessment.
- Assess the model according to presentation and content as detailed in the rubric provided below, and allocate each learner marks out of 50:

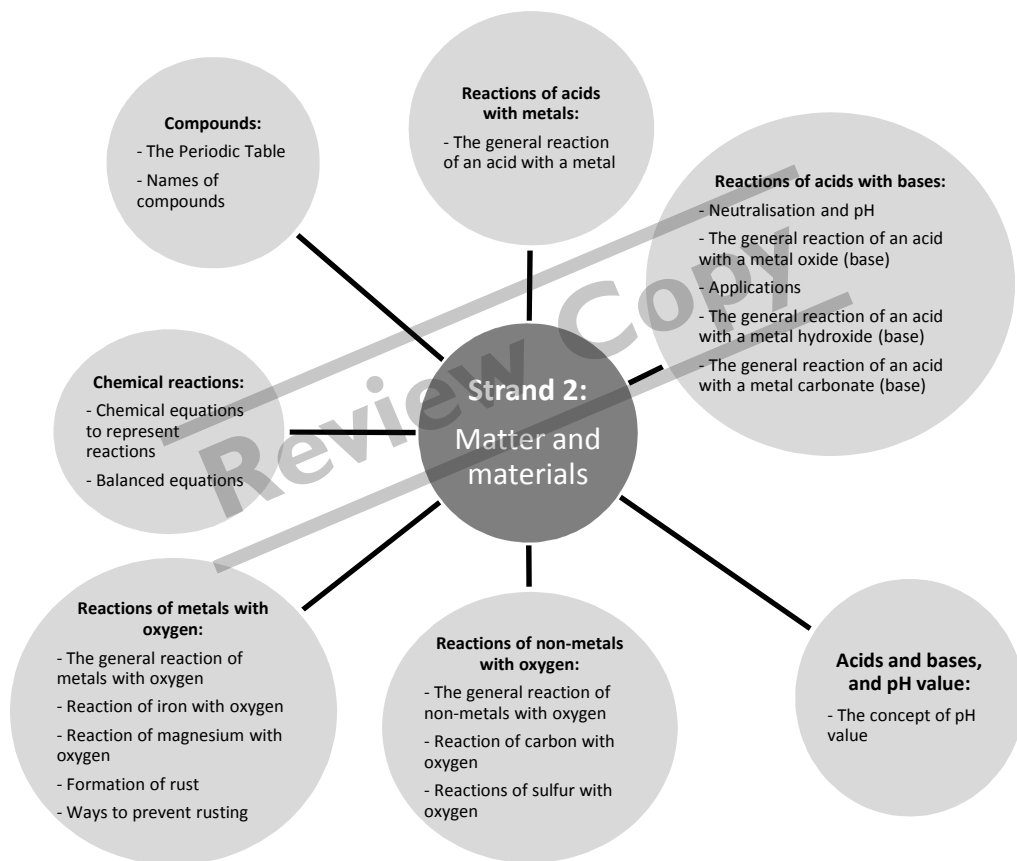
All the organs of the digestive system are in their correct place.	20
All the organs are clearly and correctly labelled.	20
The model is neat and attractive.	10

Total: 50 marks

Strand 2

Matter and materials

Core concepts covered



Strand overview

This strand begins by revising various aspects of the Periodic Table of elements that have been previously learnt. Learners are then introduced to compounds, their formulae and how they are named. Learners will find out about chemical equations

which are used to represent chemical reactions, and are shown how to balance chemical equations. The two units following this describe various general reactions of metals and non-metals with oxygen. Learners then explore acids, bases and pH and are introduced to neutralisation reactions. In Units 9 to 11, they learn about some neutralisation reactions in more depth including the general reaction of an acid with a metal oxide, an acid with a metal hydroxide and an acid with a metal carbonate. In the final unit, learners find out about the general reaction of acids with metals.

Content

Unit No.	Content	Pacing (Time allocation)	LB page	TG page
1	The Periodic Table of the Elements	1½ hours	70	74
2	Names of compounds	1½ hours	73	75
3	Chemical equations	1½ hours	76	79
4	Balanced equations	1½ hours	78	80
5	Reactions of metals with oxygen	4½ hours	80	82
6	Reactions of non-metals with oxygen	3 hours	86	87
7	Acids, bases and pH	3 hours	88	88
8	Neutralisation reactions (an introduction)	1½ hours	92	90
9	General reaction of an acid with a metal oxide	1½ hours	94	92
10	General reaction of an acid with a metal hydroxide	1½ hours	98	95
11	General reaction of an acid with a metal carbonate	1½ hours	100	97
12	General reaction of acids with metals	1½ hours	102	99

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	Investigate a selection of household substances using indicators	90	89	Rubric (20)	90
Practical task	Investigate neutralisation of a metal hydroxides by reacting dilute sodium hydroxide (NaOH) with dilute hydrochloric acid (HCl)	99	96	Memorandum (20)	96
Project	Find out more about electroplating, iron ore mining or steel production	85	86	Rubric (50)	86
Controlled test	Exemplar test: Term 2	105	186	Memorandum	186
Exam	Exemplar exam: Terms 1 and 2	107	187	Memorandum	187

Unit overview

In this unit, learners are reminded that all known elements are listed in the Periodic Table of elements. They learn that elements all have a name and a symbol, and are arranged in the Periodic Table by atomic number, which is derived from the number of protons in an atom. They also learn about the different categories that elements are grouped into on the Periodic table.

Resources

- www.youtube.com/watch?v=LFsdbLFHgY8

Teaching guidelines

- To revise the Periodic Table, ask learners if they remember anything about it.
- Write keywords on the board
- Show them a video clip on the first 20 elements of the Periodic Table.

TIP!

Get the class to recite the order of the first twenty elements in the Periodic Table together out loud.

Background knowledge

The Periodic Table always has the atomic number representing the number of protons in each atom of the element and a mass number representing the number of protons plus number of neutrons. The elements are ordered in the Periodic Table by atomic number, and in columns of elements with similar properties.

Activity 1

Revise and memorise the names and symbols of the first 20 elements of the Periodic Table.

Learner's Book page 72

Guidelines to implement this activity

- This is a group activity (five learners per group).
- Ask learners to discuss the questions and write down the answers in their notebooks.

Suggested answers

- 2 Al-Aluminium, ✓ Ar-Argon, ✓ B-Boron, ✓ Be-Beryllium, ✓ C-Carbon, ✓ Ca-Calcium, ✓ Cl-Chlorine, ✓ F-Fluorine, ✓ H-Hydrogen, ✓ He-Helium, ✓ K-Potassium, ✓ Li-Lithium, ✓ Mg-Magnesium, ✓ N-Nitrogen, ✓ Na-Sodium, ✓ Ne-Neon, ✓ O-Oxygen, ✓ P-Phosphorous, ✓ S-Sulfur, ✓ Si-Silicon ✓ (20)
- 4 iron-Fe-period 4, ✓ copper-Cu-period 4, ✓ zinc-Zn-period 4 ✓ (3)
- [23]

Total: 23 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 23 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Revise the first 20 elements of the Periodic Table with the learners.

Extension/Extension activity

Ask learners to make up a rhyme to remember the order of the first 20 elements in the Periodic table.

Unit 2 Compounds: Names of compounds

Learner's Book pages 73-75

Unit overview

In this unit, learners are introduced to the formulae for compounds, and the system or convention for naming compounds.

Resources

- hendrix2.uoregon.edu/~imamura/102/section2/chapter11.html
- www.chem4kids.com/files/atom_compounds.html
- Beads, beans, plasticine or play dough in at least two different colours.

Teaching guidelines

- Ask learners to suggest the names of various compounds and list these on the board.
- Then define the term compound and ask the learners to tick which ones on the board are correctly named as compounds and cross out those that are not compounds.

TIP!

Write the definition of compound on the board.

Background knowledge

Compounds are substances that are made up of two or more elements. As long as learners remember this definition, and what an element is, they will be able to remember what a compound is.

Activity 1

Name, write and draw pictures of molecules

Learner's Book page 75

Guidelines to implement this activity

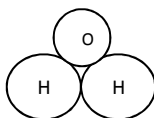
- This is an individual, pair or group activity.
- Remind learners to re-read the section in the Learner's Book on names of compounds and complete the activity by answering the questions in their notebooks.

Background knowledge

The way in which compounds are named was established by an international organisation called IUPAC (the International Union of Pure and Applied Chemistry).

Suggested answers

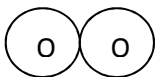
- 1 oxygen, ✓ water, ✓ carbon monoxide, ✓ carbon dioxide, ✓ copper oxide, ✓ sodium chloride, ✓ sulfur trioxide. ✓ Oxygen is not a compound. ✓ (8)
- 2 water H_2O ✓ ✓



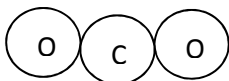
Sodium chloride- NaCl ✓ ✓



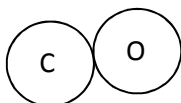
Oxygen-O₂✓✓



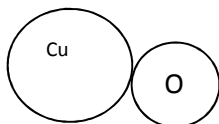
Carbon dioxide-CO₂✓✓



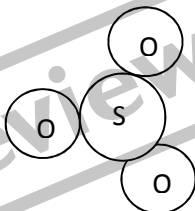
Carbon monoxide-CO✓✓



CuO✓✓



SO₃✓✓



Oxygen is not a compound.✓

(15)

[23]

Total: 23 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 23 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Go over the answers with the class and help those who are struggling. Remind them that a compound is made up of more than one element.

Extension/Extension activity

Ask learners to draw pictures of some other molecules.

Activity 2 Make models of molecules

Learner's Book page 75

Guidelines to implement this activity

- This is an individual, pair or group activity (five learners per group). Ask learners to go through the answers to Activity 1 above and make notes of the structures of the molecules to help them construct them.
- Encourage pairs to split the number of models to be made between the members of the group.

Suggested answers

Insert diagrams similar to those in Table 2 in the Learner's Book.

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):			
made accurate models of each of the molecules	3	2	0
worked effectively as a team to produce one model of each molecules	3	2	0
presented neat, attractive models.	3	2	0

[9]

Remediation/Remedial activity

Ask learners to display their models in the front of the classroom and check that all the models are correctly made. Encourage the learners to discuss the models that they have made and what makes some models more accurate and attractive than others.

Unit 3

Chemical reactions: Chemical equations to represent reactions

Learner's Book pages 76-77

Unit overview

Learners will find out about chemical equations in this unit, which are used to represent chemical reactions.

Resources

- environment.nationalgeographic.com/environment/global-warming/high-cost-coal/
- www.youtube.com/watch?v=DbmV5lM4z74
- www.youtube.com/watch?v=eO7unaE7D_0

Teaching guidelines

Show learners some video clips of reactions to introduce this topic.

Background knowledge

Chemical equations represent what happens in a chemical reaction. It is important to know that they are all based on the combination of reactants forming new substances which are the product of the reaction.

Activity 1

Model chemical reactions

Learner's Book page 77

Guidelines to implement this activity

- This is a group activity (five learners in a group). Ask learners to read through the instructions and work together to make the models and answer the questions in this activity.

Background knowledge

The carbon dioxide which humans breathe out is a (waste) product for a process in human cells involving the metabolism of glucose for energy. Carbon dioxide generated from burning coal results from the reaction of carbon (coal) with oxygen in the air.

Suggested answers

- 4 Carbon +oxygen produce carbon dioxide.
Hydrogen+oxygen produces water
- 5 $C + O_2 \rightarrow CO_2$
 $2H_2 + O_2 \rightarrow 2H_2O$
- 6 Learner's own work. Make sure they use the correct relative sizes of elements. In ascending order: H, C, O.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Ask learners to write the reactions and draw pictures of the models on the board. Ask the other learners to assess whether they are correct or not.

Activity 2 Research carbon or hydrogen fuels

Learner's Book page 77

Guidelines to implement this activity

- This is an individual activity. Take learners to the library and ask them to find out information on either the burning of coal or using hydrogen as a fuel.
- Ask them to make notes on their findings for presentation in a class discussion.

Assessment guidelines

- This activity is intended for informal assessment.
- Have a class discussion on the research that learners have carried out. Write keywords on the board. Ensure that each learner contributes some information to the discussion to show that they researched the topic adequately.

Remediation/Remedial activity

Write the equations of these two reactions on the board so that learners remember them.

Unit 4 Chemical reactions: Balanced equations

Learner's Book pages 78-79

Unit overview

In this unit, learners will find out how to balance chemical equations.

Resources

- www.youtube.com/watch?v=RnGu3xO2h74
- video.about.com/chemistry/How-to-Balance-Chemistry-Equations.htm
- www.schooltube.com/video/db41eba5cdbd45fcbe75/

Teaching guidelines

Demonstrate the concept of balanced equations by placing one orange and one apple next to each other. Then cut the apple and orange into halves. Rearrange the halves so that one orange half is next to an apple half, showing that even though the arrangement is different, you still have the equivalent of 1 orange and 1 apple.

Activity 1 Show that the chemical equations are balanced

Learner's Book page 79

Guidelines to implement this activity

- This is an individual activity. Ask learners to refer to the reactions in this unit shown on Learner's book page 78 to help them to answer these questions.

Suggested answers

1

	Number of atoms on left side	Number of atoms on right side
Fe	$4 \times 1 = 4$	$2 \times 2 = 4$
O	$3 \times 2 = 6\checkmark$	$2 \times 3 = 6\checkmark$

2.

	Number of atoms on left side	Number of atoms on right side
Mg	$2 \times 1 = 2\checkmark$	$2 \times 1 = 2\checkmark$
O	$1 \times 2 = 2\checkmark$	$2 \times 1 = 2\checkmark$

[6]

Total: 6 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 6 and give them feedback on their performance to prepare them for formal assessment.
-

Remediation/Remedial activity

Revise the answers to this activity on the board.

Activity 2

Balance chemical equations

Learner's Book page 79

Guidelines to implement this activity

- This is an individual activity. Ask learners to try and balance these equations without looking at the clues on the opposite page.

Suggested answers

- 1 $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ (2)
 - 2 $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$ (2)
- [4]

Total: 4 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 notebooks with a partner and mark them. Ask them to allocate a mark out of 4. Ask for a show of hands to assess how many learners in the class gave the correct answer.

Remediation/Remedial activity

Go over the equations with the class on the board showing each step.

Extension/Extension activity

Give learners some other equations to balance.

Unit 5

Reactions of metals with oxygen: The general reaction of metals with oxygen

Learner's Book pages 80-85

Unit overview

This unit explains the general reaction of metals with oxygen, including the reaction of iron with oxygen and the reaction of magnesium with oxygen.

Resources

- Iron reacting with oxygen:
www.youtube.com/watch?v=tNZJGf05lZ0
- Magnesium reacting with oxygen:
www.youtube.com/watch?v=Q_LU1EASadU
- Rust formation:
www.bbc.co.uk/learningzone/clips/chemical-reactions-the-production-of-rust/2298.html
- Galvanisation:
www.youtube.com/watch?v=c2J07n5hSbs
- Magnesium ribbon, Bunsen burner (or spirit lamp as heat source), matches, tongs or pliers, safety goggles.

Teaching guidelines

Show learners some video clips of reactions with oxygen.

TIP!

Highlight the region of metals on a Periodic Table hanging on the classroom wall while covering the work in this unit.

Background knowledge

Metals lie predominantly on the left hand side of the Periodic Table and towards the middle. Reactions of metals with oxygen generally result in the production of metal oxides. One of the most well-known and naturally occurring reactions of metals with oxygen is that of rusting.

Activity 1

Burn steel wool

Learner's Book page 80

Guidelines to implement this activity

- This is an individual or class activity. The teacher should demonstrate this activity.
- Read through the method with the class so that they understand what you are going to do.
- Ask them to answer the questions in the activity in their notebooks.

Background knowledge

Wear safety equipment such as goggles and use tongs or pliers as this experiment can be a fire hazard.

Suggested answers

- 1 Orange ✓ (1)
 - 2 Iron ✓ + oxygen ✓ → iron oxide ✓ (3)
 - 3 $4\text{Fe} \checkmark + 3\text{O}_2 \checkmark \rightarrow 2\text{Fe}_2\text{O}_3 \checkmark$ (3)
 - 4 $\text{Fe}=26, \checkmark \text{O}=8 \checkmark$ (2)
 - 5 Iron oxide is an orange-black powder. (1)
- [10]

Total: 10 marks

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.

Remediation/Remedial activity

Revise the experiment with the learners on the board.

Activity 2

Burn magnesium ribbon

Learner's Book page 81

Guidelines to implement this activity

- This is a class activity
- The teacher should demonstrate this activity.
- Read through the method with the class so that they understand what you are going to do.
- Ask them to answer the questions in the activity in their notebooks.

Background knowledge

Wear safety equipment such as goggles and use tongs or pliers as this experiment can be a fire hazard.

Suggested answers

- 1 White ✓ (1)
- 2 Magnesium ✓ + oxygen ✓ → magnesium oxide ✓ (3)

- 3 $2\text{Mg} \checkmark + \text{O}_2 \checkmark \rightarrow 2\text{MgO} \checkmark$ (3)
 - 4 $\text{Mg}=12, \checkmark \text{O}=8 \checkmark$ (2)
 - 5 Magnesium oxide is a white powder. (1)
- [10]

Total: 10 marks

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.

Remediation/Remedial activity

Revise the experiment with the learners on the board. Write out the stages of the reaction in a word equation and in a chemical equation.

Activity 3 Define some terms and describe a method to prevent rusting

Learner's Book page 83

Guidelines to implement this activity

- This is an individual activity
- Read through the case study with the class and explain any terms they do not understand.
- Ask them to write the answers to this activity in their notebooks.

Background knowledge

Rust is the one oxidation reaction that most people will be familiar with even though they may not understand the underlying principle.

Suggested answers

- 2 Wearing away or rusting of a metal by a chemical reaction with elements in the environment ✓ (1)
 - 3 Rust makes steel weak because it corrodes ✓ the steel. In construction, if the steel used to strengthen the construction is unprotected, the buildings and structures are weakened and they could collapse ✓ (2)
 - 4 Hot dip method and electroplating. ✓ Electroplating, because it is easier and more effective than dunking the metal parts into a bath of molten zinc. ✓ (2)
- [5]

Total: 5 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 5.

Project (PoA)	Find out more about electroplating, iron ore mining or steel production Learner's Book page 85
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Guidelines to implement this activity

- This is a group activity (four learners in a group).
- Ask learners to read the case study and careers feature on pages 84 and 85 in the Learner's Book carefully. Encourage them to discuss what they have read. Learners should also research the topic further, using the library or the internet.

Assessment guidelines

The learners' pamphlet will be assessed for presentation and content using the following criteria:

	Marks
The information is well put together, relevant, interesting and concise.	30
The presentation makes the pamphlet easy to read and attractive.	20

Assessment guidelines

- This activity is intended for formal assessment.
- Use the rubric supplied above to assess learners formally. Allocate learners a mark out of 50 and record their marks.

Remediation/Remedial activity

Revise all three reactions of metal with oxygen covered in this unit with the class.

Extension/Extension activity

Ask learners to talk about rusted things in their everyday lives. Ask learners to identify objects in the classroom or school which they think have been galvanized.

Unit 6

Reactions of metals with oxygen: The general reaction of non-metals with oxygen

Learner's Book pages 86-87

Unit overview

In this unit, the general reactions of non-metals with oxygen are explained using the reaction of carbon with oxygen and the reaction of sulfur with oxygen as examples.

Resources

- www.bbc.co.uk/bitesize/standard/chemistry/elementsandreactions/chemical_reactions/revision/2/
- www.angelo.edu/faculty/kboudrea/demos/burning_sulfur/burning_sulfur.htm
- www.bbc.co.uk/learningzone/clips/combustion-of-carbon/1853.html

Teaching guidelines

Ask learners to point out where non-metals are situated on the Periodic Table.

TIP!

Highlight the region of non-metals on a Periodic Table hanging on the classroom wall while covering the work in this unit.

Background knowledge

Non-metals lie predominantly on the right hand side of the Periodic Table. Reactions of non-metals with oxygen generally result in the production of non-metal oxides.

Activity 1

Study the reaction of sulfur with oxygen

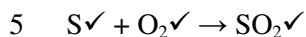
Learner's Book page 87

Guidelines to implement this activity

- This is an individual activity. Discuss the paragraph in the Learner's Book about the reaction of sulfur with oxygen and ask learners to write the answers to the activity in their notebooks.

Suggested answers

- 1 Blue✓ (1)
- 2 Sulfur dioxide SO_2 ✓ (1)
- 3 S 16 ✓, oxygen 8✓ (2)
- 4 Sulfur + oxygen \rightarrow sulfur dioxide ✓ (1)



(3)

[8]

Total: 8 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 and allocate themselves a mark out of 8.

Unit 7

Acids, bases and pH value: The concept of pH value

Learner's Book pages 88-91

Unit overview

This unit introduces the pH scale to learners. It describes the pH range of acids and bases.

Resources

- www.bbc.co.uk/learningzone/clips/universal-indicator-acid-alkali-or-neutral/121.html
- http://commons.wikimedia.org/wiki/PH_indicator
- Turmeric, bicarbonate of soda/baking soda, surgical spirits or other alcohol, filter paper/coffee filters, beakers/test tubes/glass jars, teaspoons, beverages and household substances such as water, tea, rooibos, coffee, milk, fruit juice, tartaric acid, washing powder, salt water, vinegar, lemon, soap, liquid soap, universal indicator, other indicators such as red cabbage water, red onion water, turmeric indicator or bromothymol blue or phenolphthalein, test tubes, test tube racks, droppers, marker pen or paper and sticky tape.

Teaching guidelines

- Introduce this topic by asking learners what a lemon tastes like.
- Encourage a short discussion as to why a lemon tastes sour.

Background knowledge

The pH scale was first established in 1909 by a Dane called Søren Sørensen. The pH is actually a measure of the hydrogen ion concentration in solutions.

Activity 1

Make a turmeric indicator

Learner's Book page 89

Guidelines to implement this activity

- This is an individual activity
- Ask learners to read through the method of this activity and then carry out the experiment and observe what happens.

Background knowledge

Turmeric contains an ingredient called curcumin which can act as a pH indicator.

Suggested answers

The addition of bicarbonate of soda should turn the yellow solution from yellow to red.

Assessment guidelines

- This activity is intended for informal assessment.
- Discuss with learners what they observed.

Extension/Extension activity

Ask learners to experiment by adding other substances to their home-made indicator.

Activity 2 (PoA)

Investigate a selection of household substances using indicators

Learner's Book page 90

Guidelines to implement this activity

- This is an individual activity.
- Set out the required number of test tubes in racks for the learners.
- Read through the method with the whole class so they understand what to do.
- Ask them to record their results in a table in their notebooks as shown in the activity.

Suggested answers

Table should be set out as follows:

Substance	Colour of universal indicator	Colour of turmeric indicator	Acid, base or neutral

Assessment guidelines

Use the marking rubric below to assess learners. Record the marks for formal assessment.	Marks
You tested at least seven substances.	4
You used universal indicator and one other indicator.	4
You correctly classified the substances as acids, bases or neutrals.	4
You correctly ordered the substances from most acidic to most basic.	4
You presented your results in a clear manner.	4

Total: 20 marks

Unit 8

Reactions of acids with bases: Neutralisation and pH

Learner's Book pages 92-93

Unit overview

Learners will find out how neutralisation reactions occur in which an acid and a base react together.

Resources

- www.bbc.co.uk/learningzone/clips/neutralisation-acids-and-alkalis/125.html
- www.bbc.co.uk/learningzone/clips/neutralising-stomach-acid/126.html
- www.webinnate.co.uk/science/week2.htm
- Vinegar, bicarbonate of soda, water, universal indicator, beakers or glass jars, test tubes, teaspoon, dropper.

Teaching guidelines

Introduce this unit by showing the class a video clip of some neutralisation reactions.

Activity 1

Investigate a neutralisation reaction by reacting vinegar (acid) with bicarbonate of soda (base) Learner's Book page 92

Guidelines to implement this activity

- This is a pair activity
- Read through the method with the class and ask learners to set up their test tube racks with the required amount of test tubes.

- Ask them to answer the questions in their notebooks once they have completed the experiment.

Background knowledge

Vinegar is known as acetic acid.

Suggested answers

- 1 pH decreased (1)
- 2 Universal indicator turned green (1)

Assessment guidelines

- This activity is intended for informal assessment.
- Ask learners to discuss the answers to the questions in the class.

Activity 2

Make sure you remember what to do when you get stung

Learner's Book page 93

Guidelines to implement this activity

- This is an individual activity.
- Ask the learners to read the case study and answer the questions.

Background knowledge

Bee stings are acidic and wasp stings are generally basic. Therefore bee stings should be neutralised with a basic solution and wasp stings with an acidic solution.

Suggested answers

- 2 Bee sting is acidic, wasp sting is basic.

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):			
answered the questions correctly			
invented a sensible mnemonic or memory tip to remembered what to do when stung by a bee or a wasp.			

Activity 3**Recall non-metal oxides and metal oxides**

Learner's Book page 93

Guidelines to implement this activity

- This is an individual activity. Ask learners to look back in the Learner's Book to Units 5 and 6 and re-read the sections on non-metal and metal oxides before answering the questions.

Suggested answers

1

	Non-metal oxides	Metal oxides
Acidic or basic	✓	basic✓
Examples	Carbon dioxide, ✓ sulfur dioxide✓,	Magnesium oxide✓, iron oxide✓, zinc oxide✓, iron oxide✓(any 3)

(7)

- 2 An oxide is a product formed when a metal or non-metal reacts with oxygen. ✓(1)
[8]

Total: 8 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 8 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Revise the answers to the activity to the class and explain anything that learners have difficulty with.

Unit 9**Reactions of acids with bases: The general reaction of an acid with a metal oxide (base)**

Learner's Book pages 94-98

Unit overview

This unit discusses the neutralisation reaction between an acid and a metal oxide.

Resources

- magnesium oxide powder (from Activity 2 on page 81), water, universal indicator, test tube and test tube rack OR glass containers
- www.youtube.com/watch?v=m2i9jLPXprQ
- www.chemicalengineering.org
- www.bbc.co.uk/bitesize/ks3/science/chemical_material_behaviour/acids_bases_metals/revision/6/
- www.bbc.co.uk/learningzone/clips/pollution-acid-rain/4416.html
- www.wits.ac.za

Teaching guidelines

Introducing this unit by revising what a metal oxide is.

TIP!

Write up on the board that metal oxides are bases.

Background knowledge

Metal oxides are bases and so when acid is reacted with one, it becomes less basic. If metal oxides dissolve in water, they are called an alkali.

Practical activity 1

Investigate whether magnesium oxide is an acid or a base

Learner's Book page 94

Guidelines to implement this activity

- This is an individual, pair or group activity. Ask learners to read through the method of this activity and carry it out.
- Ask them to write down their observations in their notebooks.

Suggested answers

Magnesium oxide is a base.

Assessment guidelines

- This activity is intended for informal assessment.
- Discuss the observations noted down by learners in the class.

Remediation/Remedial activity

Ask a learner to demonstrate the experiment in front of the class to show others how they arrived at their answer.

Activity 2

Read about acid rain

Learner's Book page 97

Guidelines to implement this activity

- This is an individual activity.
- Brainstorm with the class what they know about acid rain. Then ask them to read the case study and write down the answers to the questions in the activity in their notebooks.

Suggested answers

- 2 $S + O_2 \rightarrow SO_2$ ✓ (1)
 - $C + O_2 \rightarrow CO_2$ ✓ (1)
 - 3 Sulfuric acid ✓ (1)
 - 4 It lowers the pH of lakes and rivers. ✓ This often kills fish and other aquatic animals, making the water lifeless. ✓ Acid rain also leaches nutrients from the soil. ✓ Without the nutrients they need, trees and plants die. ✓ Acid rain is particularly damaging to forests. ✓ (5)
 - 5 Addition of limestone ($CaCO_3$) to make the soil less acidic (neutralisation). ✓ (1)
 - 6 Install scrubbers in chimneys or tall smokestacks to reduce sulfur dioxide emissions. ✓ (1)
- [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.

Extension/Extension activity

Ask learners to go to the library and find more information on acid rain which they can share with the class.

Activity 3**Talk about the role of chemical engineering and chemistry in agriculture**

Learner's Book page 97

Guidelines to implement this activity

- This is a class activity.
- Read through the career feature with the class and brainstorm ways in which chemistry is relevant to agriculture.
- Have a class discussion on the wastes that are produced from farming and the agriculture industry and how they can be put to good use. Discuss other possible chemical inputs into the agriculture industry.

Background knowledge

Topics to discuss would be catalytic converters on motor car exhausts, chimney scrubbers and most importantly, recycling of plant and animal waste from farms.

Assessment guidelines

- This activity is intended for informal assessment.
- Assess learners by making sure all members of the class take part in the discussion.

Extension/Extension activity

Ask learners to go to the library to find out information on questions that could not be answered in the discussion.

Unit 10**Reactions of acids with bases: The general reaction of an acid with a metal hydroxide (base)**

Learner's Book pages 98-99

Unit overview

This unit discusses the neutralisation reaction between an acid and a metal hydroxide.

Resources

- www.bbc.co.uk/bitesize/ks3/science/chemical_material_behaviour/acids_bases_metals/revision/5/

- Dilute sodium hydroxide, dilute hydrochloric acid, universal indicator, test tubes, test tube racks, glass containers (beakers/glass jars), heat source (such as Bunsen burner or spirit lamp), evaporating tin, tripod, dropper.

Teaching guidelines

Ask learners to suggest what kind of compound drain cleaner is.

TIP!

While teaching this unit, write up on the board $\text{metal} + \text{water} \rightarrow \text{hydroxide}$

Practical activity 1 (PoA)

Investigate neutralisation of metal hydroxides by reacting dilute sodium hydroxide (NaOH) with dilute hydrochloric acid (HCl) Learner's Book page 92

Guidelines to implement this activity

- This is a pair activity.
- Once divided into pairs, read through this activity with learners and explain anything they do not understand.

Background knowledge

The change in colour from red to green to yellow can happen in just one drop so it is important to warn learners to add drops slowly when the red colour starts to change.

Suggested answers

- 1.1 Hydrochloric acid ✓ + sodium hydroxide ✓ → sodium chloride ✓ + water ✓ (4)
- 1.2 $\text{HCl} \checkmark + \text{NaOH} \checkmark \rightarrow \text{NaCl} \checkmark + \text{H}_2\text{O} \checkmark$ (4)
- 1.3 Table salt ✓ (1)
- 1.4 11 ✓, 17 ✓ (2)
- 2 The crystalline product ✓ of an acid-base neutralisation reaction ✓ (2)
- 3 The solution starts with a blue colour. ✓ The indicator turns green ✓ as it reaches a pH of 7. ✓ (3)
- 4 A = potassium chloride ✓
 B = water ✓
 C = KOH ✓
 D = KCl ✓ (4)

[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.

Remediation/Remedial activity

Go through the answers to this activity with the class.

Unit 11

Reactions of acids with bases: The general reaction of an acid with a metal carbonate (base)

Learner's Book pages 100-101

Unit overview

This unit discusses the neutralisation reaction between an acid and a metal carbonate.

Resources

- Chalk dust, dilute hydrochloric acid, water, universal indicator, 2 test tubes, beakers, a balloon, limewater
- www.youtube.com/watch?v=MPIsPWxLh6U

Teaching guidelines

Show learners some chalk, bone and eggshell and ask them if they can name the main ingredient of these items.

TIP!

While teaching this unit, write up on the board: acid + metal carbonate → carbon dioxide + water.

Activity 1

Learn about antacid

Learner's Book page 100

Guidelines to implement this activity

- This is an individual and class activity. Read the careers feature on antacid and then ask learners to go to the library and look up some more information on antacids in books or on the internet.
- Have a class discussion to answer the questions in this activity.

Background knowledge

Calcium carbonate is a common ingredient of antacids which reacts with the acid in the human stomach to neutralise it and reduce discomfort.

Suggested answers

- 1 An antacid is a substance taken by humans who have indigestion. The antacid has calcium carbonate in it, which reacts with the HCl in the stomach to neutralise it.
- 2 It is common to burp as the reaction results in carbon dioxide being produced.

Assessment guidelines

- This activity is intended for informal assessment.
- Discuss the answers to this activity in the class and ask for a show of hands for how many learners got the answers correct.

Remediation/Remedial activity

Revise the reaction on the board for learners who are having difficulty.

Practical activity 2

Investigate neutralisation of metal carbonates by reacting chalk dust (calcium carbonate, CaCO_3) with dilute hydrochloric acid (HCl)

Learner's Book page 101

Guidelines to implement this activity

- This is a pair activity.
- Read through the activity with the class and ask them to set up their test tubes.
- Warn them to be very careful when pouring HCl.
- Remind them of what limewater is used to test for.

Background knowledge

HCl is corrosive, so warn learners to be very careful when pouring this. They should preferably wear some protective clothing.

Suggested answers

- 1 Hydrochloric acid✓ + calcium carbonate✓ → calcium chloride ✓ + water✓ + carbon dioxide✓
 $2\text{HCl} \checkmark + \text{CaCO}_3 \checkmark \rightarrow \text{CaCl}_2 \checkmark + \text{CO}_2 \checkmark + \text{H}_2\text{O} \checkmark$ (10)
- 2 The limewater turned milky.✓ (1)

Total: 11 marks

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 11.

Unit 12

Reactions of acids with metals: The general reaction of acids with metals

Learner's Book pages 102-103

Unit overview

This unit discusses the neutralisation reaction between an acid and a metal carbonate.

Resources

- Magnesium, dilute hydrochloric acid, water, beakers/glass jars, test tubes, wooden splint or matches, matches
- www.youtube.com/watch?v=d3uzkCNJQLY
- www.bbc.co.uk/bitesize/ks3/science/chemical_material_behaviour/acids_bases_metals/revision/7/

Teaching guidelines

Ask learners what they know about hydrogen. Ask what kind of molecules have hydrogen, what is hydrogen, what does it look like etc.

TIP!

While teaching this unit, write up on the board: acid + metal \rightarrow salt + hydrogen gas

Practical activity 1

Investigate reactions of acids with metals by reacting dilute hydrochloric acid (HCl) with magnesium

Learner's Book page 103

Guidelines to implement this activity

- This is a pair activity.
- Ask learners to read through the activity and ask if they need something explained. Refer them to the section in the Learner's Book in this unit for revision.
- Again, warn them about the dangers of handling hydrochloric acid.

Background knowledge

This test should be performed as quickly as possible for it to work effectively; otherwise the hydrogen will have dissipated.

Suggested answers

- 1 Hydrochloric acid✓ + magnesium✓ →magnesium chloride ✓+ hydrogen✓
 $\text{HCl}✓ + \text{Mg} ✓ \rightarrow \text{MgCl}_2✓ + \text{H}_2✓$ (8)
 - 2 Hydrogen gas✓ (1)
 - 3 Hydrogen gas is very explosive, ✓ and it caused the glowing wooden splint to explode which paused a popping sound. ✓ (2)
- [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.

Remediation/Remedial activity

Go over the results of the activity with learners who are having difficulty.

Activity 2

Write a summary of general chemical reactions

Learner's Book page 103

Guidelines to implement this activity

- This is an individual, pair or group activity. Ask learners to refer to the relevant parts of the Learner's Book when answering the questions to this activity. It might be easier if you suggest to learners to write their answers up in a table.

Suggested answers

Chemical reactions	General reaction	Example
metals with oxygen✓	metal +oxygen → metal oxide✓	iron + oxygen → iron oxide✓ $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$ magnesium + oxygen →magnesium oxide✓ (any 1) $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

non-metals with oxygen✓	non-metal + oxygen → non-metal oxide✓	carbon + oxygen → carbon dioxide $C + O_2 \rightarrow CO_2$ sulfur + oxygen → sulfur dioxide $S + O_2 \rightarrow SO_2$
acids with bases (neutralisation) ✓	acid + base → neutral✓	cetic acid + sodium bicarbonate →✓sodium acetate + carbon dioxide + water $CH_3COOH + NaHCO_3 \rightarrow NaCH_3COO + CO_2 + H_2O$ *
acids with metal oxides✓	metal oxide + acid → salt + water✓	hydrochloric acid + magnesium oxide → magnesium chloride + water✓ $2HCl + MgO \rightarrow MgCl_2 + H_2O$
acids with metal hydroxides✓	acid + metal hydroxide → salt + water✓	hydrochloric acid + sodium hydroxide → sodium chloride + water✓ $HCl + NaOH \rightarrow NaCl + H_2O$
acids with metal carbonates✓	acid + metal carbonate → salt + carbon dioxide + water✓	hydrochloric acid + calcium carbonate → calcium chloride + carbon dioxide + water✓ $2HCl + CaCO_3 \rightarrow CaCl_2 + CO_2 + H_2O$
acids with metals✓	acid + metal → salt + hydrogen gas✓	hydrochloric acid + magnesium → magnesium chloride + hydrogen✓ $2HCl + Mg \rightarrow MgCl_2 + H_2$

[21]

Total: 21 marks

Assessment guidelines

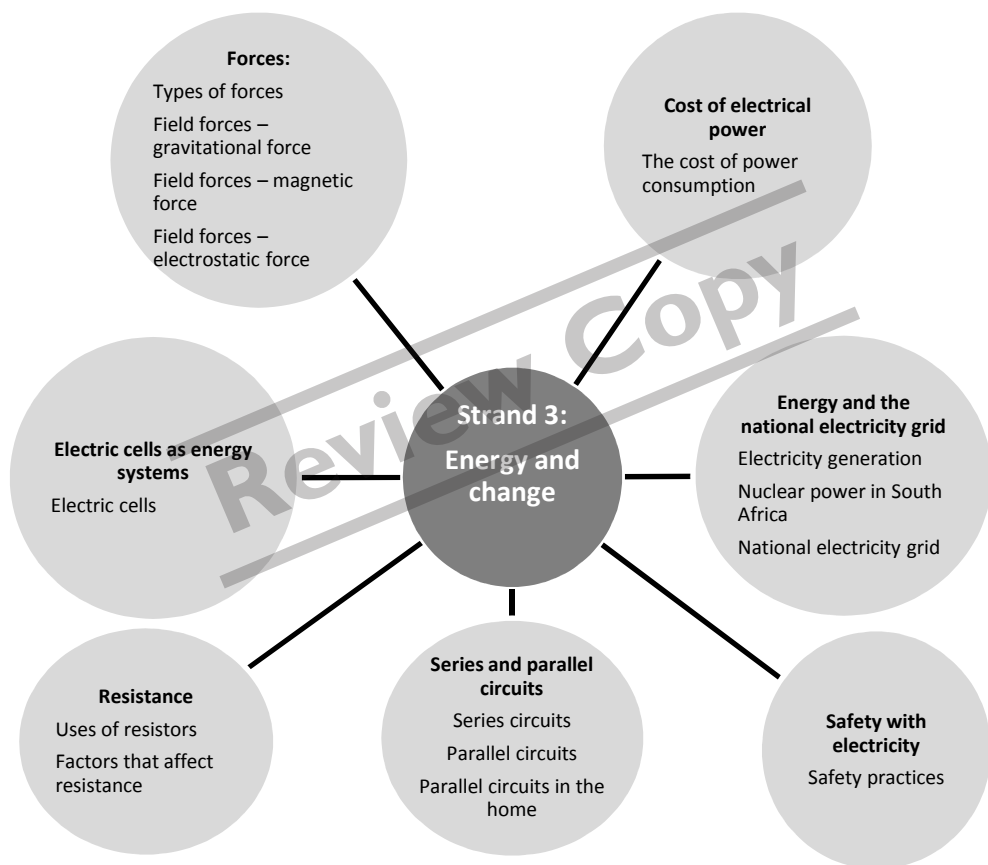
- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 21 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Ask learners who did not complete the table correctly, to rewrite it as this is a good tool to learn from for tests.

Strand 3

Core concepts covered



Strand overview

This strand concentrates on looking at the different forces that provide energy and change. To begin with, learners are introduced to the types of forces that move things. Learners find out about the way in which they act on different objects and on each other. Learners then find out more about electricity, the energy it produces and how

electricity is generated in different ways. Different types of circuits are discussed as well as safety measures to be taken with regard to electricity. Finally, learners explore how electricity is distributed throughout the country and the cost of electrical power.

Content

Unit No.	Content	Pacing (Time allocation)	LB page	TG page
1	Forces: Types of forces	1 hour	110	105
2	Forces: Field forces – gravitational force	2 hours	115	107
3	Forces: Field forces – magnetic force	1 hour	118	110
4	Forces: Field forces – electrostatic force	2 hours	123	114
5	Electric cells as energy systems: Electric cells	1½ hours	126	116
6	Resistance: Uses of resistors	1½ hours	128	120
7	Resistance: Factors that affect resistance	1½ hours	130	120
8	Series and parallel circuits: Series circuits	3 hours	134	126
9	Series and parallel circuits: Parallel circuits	1½ hours	140	132
10	Series and parallel circuits: Parallel circuits in the home	1½ hours	144	137
11	Safety with electricity: Safety practices	1½ hours	148	140
12	Energy and the national electricity grid: Electricity generation	1 hour	154	143
13	Energy and the national electricity grid: Nuclear power in South Africa	1 hour	156	145
14	Energy and the national electricity grid: National electricity grid	1 hour	158	145
15	Cost of electrical power: The cost of power consumption	6 hours	160	146

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	Investigate the effect of different thickness of materials on resistance	133	124	Memorandum (20)	124
Project	Plan an investigation to get the highest voltage	127	118	Rubric (20)	118
	Investigate the effect of connecting more cells in series	135	126	Memorandum (20)	126
Controlled test	Exemplar test	165		Memorandum	189

Review Copy

Unit 1 Forces: Types of forces

Learner's Book pages 110–114

Unit overview

In this unit learners find out about the effects of forces on objects and how forces act in pairs. They will also learn about different types of forces.

Resources

- Ping pong ball or an inflated balloon, eraser, book or wooden block, sponge, piece of fabric
- www.history.com/shows/the-universe/videos/playlists/beyond-the-big-bang

Teaching guidelines

Introduce the concept that objects require a pull or push to be moved by asking learners how they can make the objects on their desks move.

Background knowledge

Sir Isaac Newton was an English academic (1672–1727) who laid the foundations for some of the most important physical aspects of force. He was responsible for describing gravitation and the all-important Laws of Motion.

Practical activity 1 Investigate what physical forces do

Learner's Book page 111

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Divide the class into groups and ask them to follow the method in this activity.
- Ask them to record their results in a table as shown in the activity.

Suggested answers

Force on object	Effect of force
Pushing or blowing	It moves
Hitting another object	It slows down and stops
Flicking	It changes direction
Squeezing	It changes shape

Conclusion

When a force is exerted on an object, it is moved.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Discuss the results of the activity and make sure that everyone came to the same conclusion.

Practical activity 2

Investigate push and pull forces

Learner's Book page 112

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Use the same groups for this activity. Ask learners to carry out the method and make notes on their observations in their notebooks.

Suggested answers

- 1 The wall pushes back with the same force exerted on it.
- 2 Yes.
- 3 If the person moves it means you exerted a bigger force on them than they exerted on you.
- 4 Yes. The force is bigger.
- 5 If the person moves it means you exerted a bigger force on them than they exerted on you.
- 6 The person would move towards them.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Discuss the results of this activity with the class. Make sure that all learners contribute to the discussion.

Activity 3

Identify forces in balance

Learner's Book page 113

Guidelines to implement this activity

- This is a group activity.
- Ask learners to discuss the questions asked in this activity and answer the questions in their notebooks.

Suggested answers

- 1a. Force of woman on chair, ✓ force of chair on woman, ✓ balanced ✓ (3)
 - 1b. Force of one boy, ✓ force of second boy, ✓ not balanced ✓ (3)
 - 1c. Force of boy on girl, ✓ force of girl on boy, ✓ balanced ✓ (3)
 - 1d. Force of cricket ball on window, ✓ force of window on ball, ✓ not balanced ✓ (3)
 - 2 Use arrows. ✓ Arrows of equal length indicate balanced forces. ✓ Arrows of unequal length indicate unbalanced forces. ✓ (3)
- [15]

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.

Unit 2 Forces: Field forces – gravitational force

Learner's Book pages 115–117

Unit overview

This unit describes how gravitational forces attract subjects towards each other. Learners will find out the effects of mass and distance on gravitational force. The relationship between mass and weight are defined and learners will find out how to measure forces.

Resources

- Objects such as: a book, stone, feather, leaf, eraser, a spring balance, mass pieces or different objects, such as stones in a plastic carrier bag, a teacup, a small bucket of sand
- www.youtube.com/watch?v=LEs9J2IQIZY
- www.bbc.co.uk/learningzone/clips/gravity-and-its-effects-on-a-stunt-artist/1598.html

Teaching guidelines

Drop a book onto the ground and ask learners to suggest what forces were in play to cause it to fall to the ground.

Background knowledge

Gravitational force was defined by Sir Isaac Newton and can be calculated by the formula $F = mg$ where m represents mass (kg) and g represents the gravitational force on Earth of 10m/second^2 . The unit for gravitational force is the Newton (N).

Practical activity 1

Demonstrate gravitational force

Learner's Book page 115

Guidelines to implement this activity

- This is a pair activity.
- Ask learners to read through the method of this activity and answer the questions in their notebooks.

Suggested answers

- 1 They fell to the ground ✓ (1)
 - 2 The gravitational force of the Earth ✓ exerts a pulling force on the objects. ✓ (2)
 - 3.1 Yes, ✓ the heavier ones fell faster. ✓ (1)
 - 3.2 The force with which an object falls is dependent on the mass of the object. ✓ (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 swap their notebooks with a partner and mark them. Ask learners to allocate a mark out of 5 and give them feedback on their performance to prepare them for formal assessment.

Activity 2

Calculate weight

Learner's Book page 117

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to refer to the information in this unit for help with this activity.

Suggested answers

- 1.1 $F = mg$
 $= 45\text{ kg} \times 10\text{m/second}^2$ ✓

$$450 \text{ N} \checkmark \quad (2)$$

$$1.2 \quad F = mg$$

$$= 45 \text{ kg} \times 5 \text{ m/second}^2 \checkmark$$

$$= 225 \text{ N} \checkmark \quad (2)$$

$$2.1 \quad F = mg$$

$$m = F/g$$

$$m = 60 \text{ N} / 10 \text{ m/second}^2 \checkmark$$

$$m = 6 \text{ kg} \checkmark \quad (2)$$

$$2.2 \quad \text{Bag weight on Zogg} = F = mg$$

$$= 6 \text{ kg} \times 5 \text{ m/second}^2 \checkmark$$

$$= 30 \text{ N} \checkmark \quad (2)$$

[8]

Total: 8 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 8 and give them feedback on their performance to prepare them for formal assessment.

Practical activity 3 Measure and record weights of objects

Learner's Book page 117

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Divide the class into groups and read through the activity with learners so they understand what to do.
- Make sure learners understand how to read the mass of an object on the spring balance.
- Ask them to draw up a table listing the object weighed and the mass of the object.

Suggested answers

Object	Mass (g)
Individual answer	Individual answer

Assessment guidelines

- This activity is intended for informal assessment.

- Check the tables that learners have drawn up to see that they have accurately measured the weights of the various objects.

Remediation/Remedial activity

Ask learners who have grasped the method for measuring weights of objects to help those who are struggling.

Unit 3 Forces: Field forces – magnetic force

Learner's Book pages 118–122

Unit overview

This unit introduces magnetic substances. Learners find out about materials that magnetic forces can act through and also how magnetic poles attract or repel objects. They also learn about how magnetic poles attract or repel objects and the magnetic fields in magnets and the Earth.

Resources

- Two bar magnets, substances such as: a stainless steel spoon, iron nail, plastic, wood, paper, brass tacks or drawings, aluminium foil, magnet, pins, sheet of paper, piece of tin foil, plastic lid, block of wood, steel baking tray, iron filings, piece of paper, ruler
- www.bbc.co.uk/learningzone/clips/magnets-and-their-invisible-force/2185.html

Teaching guidelines

Ask learners to describe what happens when they play with magnets.

TIP!

Show learners what happens between a magnet and a metal to demonstrate that the magnet exerts a force on the metal.

Background knowledge

A magnetic force is the force that is exerted between magnetic poles. It was discovered that a magnetic force exists between two electrically-charged moving particles.

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Ask learners to read through the activity and carry out the instructions.
- Ask them to write their observations down in their notebooks.

Suggested answers

1.1

Substance	Prediction	Result
Wood	not attracted	not attracted
Brass tacks	attracted	attracted
Aluminium foil	attracted	not attracted
Plastic	not attracted	not attracted
Steel spoon	attracted	attracted

1.2 Individual answer depends on predictions made,

- 2 Some objects, such as brass tacks and a stainless steel spoon, are magnetic. Objects made of wood and plastic are not magnetic. Metal objects that do not contain iron will not be magnetic.

Assessment guidelines

This activity is intended for informal assessment.

Use the suggested answers supplied above to assess learners informally. Have a class discussion and ask learners to share their observations from this activity.

Remediation/Remedial activity

Ask learners to test some other objects to see whether they are magnetic or not.

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Keep the same groups used for the previous activity and ask learners to read through the activity and carry out the investigation.
- Ask learners to record their results in their notebooks.

Suggested answers

- 2 Hypothesis: magnetic forces attract objects through other materials. ✓ (1)
- 3 Independent variable: magnet ✓ Dependent variable: different objects ✓ (2)
- 4 By using the same magnet for the entire investigation. ✓ (1)

Observations

1

Object	Magnetic force acting through object?
Hand	No
Tin foil	Yes
Plastic lid	Yes
Baking tray	Yes
Block of wood	No

✓✓✓✓✓

(5)

- 2 Yes ✓

(1)

Conclusion

Magnetic forces can act through other materials. ✓✓

(2)

[12]

Total: 12 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers/memorandum supplied above to assess learners informally. Ask learners to mark their own work and allocate themselves a mark out of 12 for informal assessment.

Practical activity 3

Magnetic fields: Observe patterns made by a magnet on iron filings

Learner's Book page 120

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Ask learners to read through the activity carefully. Make sure they do not sprinkle the iron filings over too big an area.
- Ask them to record their observations in their notebooks.

Suggested answers

- 1.1 The iron filings made a pattern. ✓ (1)
1.2 Close to the magnet. ✓ (1)
1.3 This is where the magnetic force is strongest. ✓ (1)
2.1 The iron filings followed the direction of the forces in the magnetic field. ✓ (1)
2.2 The filings were attracted by magnetic forces. ✓ (1)
3.1 The iron filings did not move. ✓ (1)
3.2 They were out of the magnet's magnetic field and were not attracted by magnetic forces. ✓ (1)
[7]

Total: 7 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers/memorandum supplied above to assess learners informally. Ask learners to mark their own work and allocate themselves a mark out of 7 for informal assessment.

Practical activity 4 Investigate attraction and repulsion in magnets

Learner's Book page 122

Guidelines to implement this activity

- This is an individual, pair or group activity (four learners per group).
- Ask learners to follow the instructions for this activity and make notes of their observations in their notebooks for a class discussion.

Suggested answers

	Attracts	Repels
North pole and north pole		✓
South pole and south pole		✓
North pole and south pole	✓	

Assessment guidelines

- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Discuss the observations with the class and read the explanation for these observations in the Learner's Book with the class.

Remediation/Remedial activity

Revise with the class what happens when opposite poles of a magnet are put together and when opposite poles are brought together.

Unit 4 Forces: Field forces – electrostatic force

Learner's Book pages 123–125

Unit overview

This unit explains how some materials become charged when they are rubbed together. Learners find out that charged objects can attract or repel each other. The cause of thunder and lightning is explained and they will learn how to take safety precautions during lightning and thunderstorms.

Resources

- Plastic comb or pen, Perspex ruler, glass, inflated balloon, plastic bags, piece of dry silk cloth, woollen cloth, cotton cloth, small pieces of tissue paper
- www.sciencekids.co.nz/videos/weather.html
- www.youtube.com/watch?v=Ne7oqESE5Zw

Teaching guidelines

Show learners a video clip of opposite charges attracting each other and the same charges repelling each other.

TIP!

Keep this up on the board: Like charges repel and opposite charges attract.

Background knowledge

A material that gains electrons becomes negatively charged and one that loses electrons becomes positive. It is this status which causes materials to have potential energy and therefore can be used for various applications.

Practical activity 1 Investigate electrostatic forces

Learner's Book page 124

Guidelines to implement this activity

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

- Read through the activity with the class and make sure learners understand what to do.
- Ask learners to write down their observations in their notebooks for discussion.

Background knowledge

The weather conditions must be dry for this activity, because water molecules in damp conditions attract the charges away from the charged objects.

Suggested answers

- 1 No. It is not charged by rubbing. ✓ (1)
- 2.1 Balloon, ruler, glass, plastic bag ✓ (1)
- 2.2 None ✓ (1)
- 2.3 All ✓ (1)
- 3.1 Balloon, ruler, glass, plastic bag ✓ (1)
- 3.2 None ✓ (1)
- 3.3 All ✓ (1)
- 4.1 Balloon, ruler, glass, plastic bag ✓ (1)
- 4.2 None ✓ (1)
- 4.3 All ✓ (1)
- 4.4 The objects that were charged by rubbing with the different cloths all had the same charge on them. ✓ Objects with unlike charges attract one another. ✓ Objects with like charges repel one another, so these object repelled each other ✓. The charged objects attracted the paper because the paper was uncharged. ✓ (4)

[14]

Total: 14 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 14 and give them feedback on their performance to prepare them for formal assessment.

Activity 2

Make an information sheet about lightning safety

Learner's Book page 125

Guidelines to implement this activity

- This is a pair activity.

- Take learners to the library to research safety precautions during lightning and thunderstorms.
- Ask them to make an information sheet according to the instructions in this activity.

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):			
used simple language			
included pictures			
included at least five safety precautions.			

Remediation/Remedial activity

Ask learners to share their information sheets with the class so they can see what other learners have written about.

Unit 5 Electric cells as energy systems: Electric cells

Learner's Book pages 126–127

Unit overview

This unit describes the various parts of a cell and how they provide energy for circuits. The difference between a cell and a battery is explained.

Resources

- Three citrus fruits, such as lemons or oranges, different metal plates or nails to use as electrodes, three copper and three zinc, at least 5cm long or longer, connecting leads with crocodile clips, light bulb and bulb holder or LED bulb (Light Emitting Diode) or a sensitive voltmeter/multimeter.
- www.connectionsacademy.com/blog/posts/2012-03-15/Kitchen-Science-for-Kids-Making-a-Battery-Out-of-a-Lemon.aspx
- netattic.net/science-and-technology/citrus-fruit-and-electricity/
- videos.howstuffworks.com/howstuffworks/51311-stuff-to-blow-your-kids-mind-static-electricity-video.htm

Teaching guidelines

Introduce this unit by asking learners what they understand about a cell. Read the definition of a cell to them from this unit.

TIP!

Make sure learners understand the difference between a cell and a battery.

Background knowledge

It is important to understand that a cell is a single unit which generates electricity. A battery is a combination of two or more cells fashioned into a single unit, which is the item that you buy at a shop.

Practical activity 1

Make a cell or battery using acidic fruit

Learner's Book 127

Guidelines to implement this activity

- This is a pair activity.
- Read through the method of this activity carefully before beginning.
- Ask learners to record their observations in their notebooks.

Background knowledge

This can be a disappointment if it is not set up correctly, so it may be preferable for you to demonstrate how this activity works first before allowing learners to set up the investigation.

Conclusion

Bulb/LED does not glow with only one lemon. When more lemons are added it glows. The fruit contains positively and negatively charged ions. When the zinc nail or plate was inserted into the fruit the negatively charged ions moved from the fruit to the zinc nail. When the circuit is completed, electricity is generated and the bulb lights up.

Assessment guidelines

- This activity is intended for informal assessment.
- Use the memorandum supplied above to assess learners informally. Discuss the results of this activity with the class.

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to read through this activity carefully and plan what to do.
- Ask them to carry out their investigation and record results in their notebooks for formal assessment.

Suggested answers

- Learners could suggest apples, tomatoes, oranges or grapefruit. Acidic fruits are best.
- Types of fruit
- Voltage, with a multimeter, a voltmeter, or by looking at the brightness of the LED or lamp.
- Same size bulb and same type and length of connecting wires to make sure that the test is fair.
- Results can be recorded in a table. For example, data table for a fruit battery made of different kinds of fruit.

Fruit battery in Series	Volts produced (units)	Lit bulb (yes or no, dull or bright)
1 apple		
2 apples		
3 apples		
1 orange		
2 oranges		
3 oranges		
1 grapefruit		

- The report should
 - be neatly written or typed in your own words
 - have a cover page with the date, your name and the project title on it
 - have a contents page with headings and page numbers
 - have three to four pages of content excluding the cover and contents pages.

Make sure that:

- The experimental question is worded correctly.
- A likely hypothesis is presented.
- The experimental design is likely to produce some data that can be used to prove or disprove the hypothesis.

- The experimental method is clearly laid out and easy to follow.
- The results are presented in tables and in an appropriate graph.
- The discussion correctly describes how the data proves or disproves the hypothesis.
- The conclusion logically links the data to the experimental question .

Assessment guidelines

This activity is intended for informal assessment.

Use the marking rubric below to assess learners. Give them a mark out of 20 and feedback to prepare them for formal assessment.

Criteria	Excellent	Good	Average	Needs help
Hypothesis/prediction 3 marks	Hypothesis or prediction has been well developed. 3 marks	Hypothesis or prediction has been sufficiently developed. 2 marks	Hypothesis or prediction has been partially developed. 1 mark	Hypothesis or prediction poorly developed with little understanding of task / not developed. 0 marks
Investigation design 10 marks	Learner plans a fair test that identifies what they will observe and measure, includes a materials list and sequential steps, and describes variables and how all but one will be kept constant, if necessary. 8-10 marks	Learner plans a fair test that includes most of the elements of a fair test. 6-7 marks	Learner plans a fair test that includes some of the elements of a fair test. 3-5 marks	Student can not yet develop a fair test, list materials and identify variables. 0-2 marks
Methods of data collection and recording 7 marks	Data is accurately recorded and displayed using the most relevant and organised methods 6-7 marks	Data is recorded and displayed using organised methods. 4-5 marks	Data is recorded and displayed but may lack some organisation. 2-3 marks	Data has not been recorded or displayed in an organised way. 0-1 mark
Total				20 marks

Unit 6 Resistance: Uses of resistors

Learner's Book pages 128–129

Unit overview

Learners will find out how resistors work in this unit. They will learn about different kinds of resistors and why resistors are useful.

Resources

- Assortment of resistors: bulbs, rheostats, motors, light sensitive diodes and light emitting diodes (LEDs).
- en.wikipedia.org/wiki/File:3_Resistors.jpg

Teaching guidelines

Show some examples or pictures of different resistors to the class.

Background knowledge

In small circuits like those used in the electronic industry, resistors are tiny components designed so that they can fit into the circuit and do not necessarily have a duplicate function like a light bulb.

Unit 7 Resistance: Factors that affect resistance

Learner's Book pages 130–133

Unit overview

In this unit, learners will find out how to measure current with an ammeter. Some different factors that change resistance will be explained.

Resources

- Two cells, light bulb, equal lengths of copper, Eureka and nichrome wire of the same thickness, ammeter, switch, different thickness of nichrome wire of the same length
- www.bbc.co.uk/learningzone/clips/measuring-electrical-resistance/270.html
- www.bbc.co.uk/learningzone/clips/resistance-in-a-circuit/4.html

Teaching guidelines

Recap what resistance is with the class. Refer back to Unit 6 if necessary.

Background knowledge

Eureka wire consists of nickel 45% and copper 55%. It works at a temperature of 400 °C and it has a melting point of 1 270 °C.

Practical activity 1

Investigate the effect of different materials on resistance

Learner's Book page 131

Guidelines to implement this activity

- This is a group activity (five learners per group).
- Read over the activity with the class and go through the circuit diagram with them to make sure they understand what all the symbols mean.

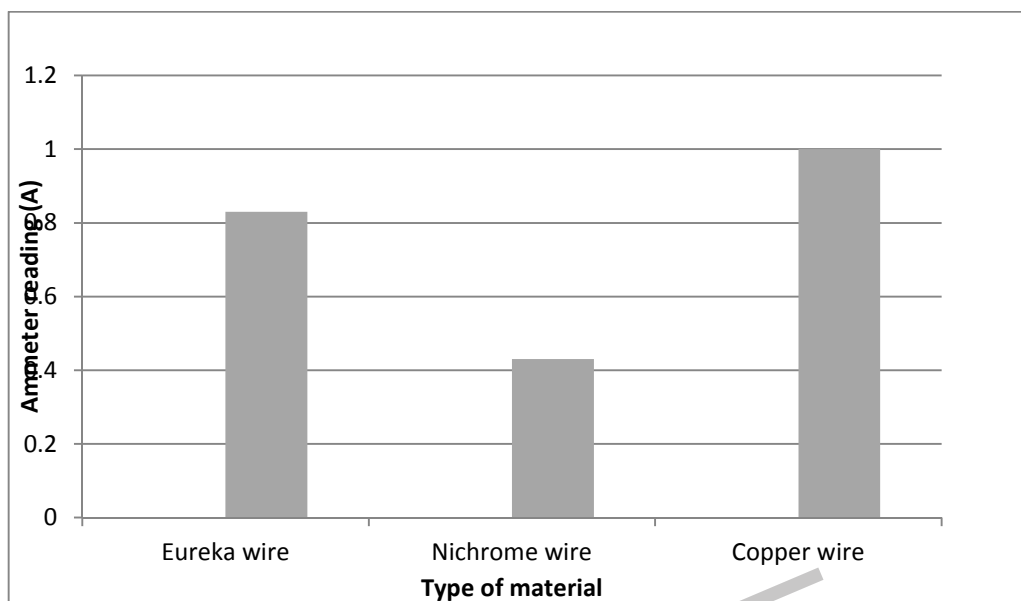
Suggested answers

- 4 Independent variable: type of conductor, ✓ dependent variable: current in Amperes ✓ (2)

Results

Type of material	Ammeter reading (A)
Eureka wire	0,83 ✓
Nichrome wire	0,43 ✓
Copper wire	1.0 ✓

(3)



Correct x -axis, ✓✓ correct y -axis, ✓✓ correctly plotted points ✓ (5)

- 3 Yes ✓ because all of the other variables that could affect the results are kept the same. ✓ For example, the length and diameter of the materials, the number of cells and leads. (2)

Conclusion

Copper and Eureka wire have a lower resistance than nichrome wire. ✓✓ (2)

[14]

Total: 14 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 14 and give them feedback on their performance to prepare them for formal assessment.

Extension/Extension activity

Ask learners to test some different kinds of wire in this circuit to compare readings

Guidelines to implement this activity

- This is a group activity (five learners per group).
- Read over the activity with the class and go through the circuit diagram with them to make sure they understand what all the symbols mean.
- Check their circuits before they begin this activity.
- Ask learners to write results down in their notebooks.

Suggested answers

- Learners must predict how length of material will affect resistance.
- Independent variable: different lengths of conductor, ✓ dependent variable: current in Amperes. ✓ (2)

Results

1

Length of nichrome wire (mm)	Ammeter reading (A)
17	1.6 ✓
52	0.8 ✓
68	0.3 ✓

(3)

2



Correct x-axis, ✓✓ correct y-axis, ✓✓ correctly plotted points ✓ (5)

- Yes ✓ because all of the other variables that could affect the results are kept the same ✓, for example, the type of material and diameter of the materials, the number of cells and leads. (2)

Conclusion

As the length of the wire increases, ✓ the current decreases and the resistance increases ✓

(2)

[14]

Total: 14 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 14 and give them feedback on their performance to prepare them for formal assessment.

Extension/Extension activity

Ask learners to test more different lengths of wire in this circuit to compare readings.

Practical activity 3 (PoA)

Investigate the effect of different thickness of materials on resistance

Learner's Book page 133

Guidelines to implement this activity

- This is a pair activity, but learners must write up their results and conclusions on their own.
- Read over the activity with the class and go through the circuit diagram with them to make sure they understand what all the symbols mean.
- Check their circuits before they begin this activity.
- Ask learners to write results down in their own notebooks.

Suggested answers

3 Learners must predict how the diameter of material will affect resistance. ✓ (1)

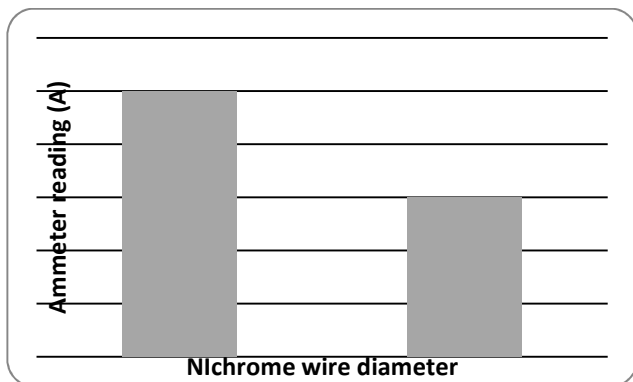
4 Independent variable: different diameters of nichrome, ✓ dependent variable: current in Amperes. ✓ (2)

Results

1

Diameter of nichrome wire (mm)	Ammeter reading (A)
0.4	0.5
0.2	0.3

(3)



Correct x -axis, ✓ correct y -axis, ✓ correctly plotted points ✓

(5)

3 The graph descends from left to right.

3.1 Current strength decreases with diameter.

(1)

3.2 As one increases, the other decreases proportionally.

(1)

3.3 The thicker the wire, the greater the resistance.

(1)

4 Yes ✓ because all of the other variables that could affect the results are kept the same. ✓ For example, the type of material and length of the materials, the number of cells and leads.

(2)

Conclusion

As the diameter of the wire increases, the current increases and the resistance decreases. ✓

(2)

The experiment could be improved by recording resistance of the same thickness of wire with 1, 2 and 3 cells.

(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.

Unit 8 Series and parallel circuits: Series circuits

Learner's Book pages 134–139

Unit overview

This unit explains how components are connected in series in circuits. The effects of connecting more cells in series on voltage and current are described and learners will find out the effects of connecting more resistors in series on voltage and current.

Resources

- Three cells, three bulbs, a switch, connecting wires, two voltmeters, two resistors with different resistance, like 40W and 100W bulbs, ammeter
- www.bbc.co.uk/bitesize/ks3/science/energy_electricity_forces/electric_current_voltage/revision/4/
- teachertube.com/search_result.php?query=series+circuit&type=videos

Teaching guidelines

- Demonstrate to learners how components are connected in series using some examples.

Background knowledge

Series circuits are the simplest electrical circuits as the current through each of the components is the same, and the voltage across the circuit is the sum of the voltages across each component.

Project (PoA)

Investigate the effect of connecting more cells in series

Learner's Book page 135

Guidelines to implement this activity

- This is a group and individual activity.
- Read through the activity and make sure learners understand what to do.
- Ask learners to write up their own results individually in their notebooks.

Suggested answers

- 1 What happens to the bulb when more cells are connected in series. (1)
- 2 The bulb will glow brighter when you add more cells in series. (3)

3 Number of cells in circuit is the independent variable. Current strength is the dependant variable. (2)

4

Step 1 Connect the circuit using one cell. Measure the current.

Step 2 Add a second cell to the circuit in series. Measure the current.

Step 3 Add the third cell to the circuit in series. Measure the current. (3)

Independent: number of cells, dependent variable: how brightly the bulb glows.

Results

Number of cells	Brightness of bulb
One cell	Dim
Two cells	Bright
Three cells	Very bright

(3)

Conclusion

1 As more cells are added into the circuit the bulb glows more brightly. The hypothesis is supported. (2)

2 The bulb did not light up – check that all components are working before starting the investigation. (1)

3 Use an instrument that can measure the current accurately, as light bulbs may not all be equal and this can make the results confusing. (1)

4 Complete these sentences:

4.1 Resistance (1)

4.2 Potential (1)

4.3 Current (1)

4.4 Current (1)

[20]

Total: 20 marks

Practical activity 2

Investigate voltage as the number of cells is increased

Learner's Book page 136

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Make sure that learners can read a voltmeter and that they set the circuit up correctly.
- Ask them to answer the questions to the activity in their notebooks.

Suggested answers

Results

1

Cell(s)	Voltmeter reading (V)
Cell one	Individual reading✓
Cell two	Individual reading✓
Cell three	Individual reading✓
Cell one, two and three	Individual reading✓

(4)

- 2 Yes ✓the total voltmeter reading equals the sum of the individual cells: one, two and three connected in series✓

(2)

[6]

Total: 6 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 6 and give them feedback on their performance to prepare them for formal assessment.

Practical activity 3 Investigate voltage in a series circuit across resistors

Learner's Book page 137

Guidelines to implement this activity

- This is a group activity (five learners per group).
- Follow the instructions in this activity and ask learners to write answers down in their notebooks.

Suggested answers

Results

1

	Voltmeter reading (V)
Resistor 1	Individual reading✓
Resistor 2	Individual reading✓
Resistor 1 and 2	Individual reading✓
Battery	Individual reading✓

(4)

- 2 Learner's own work.

- 3 The sum of the individual voltages equals the voltage across the battery ✓ (1)

Conclusion

In a series circuit the sum of the individual voltages equals the voltage across the battery.✓

(1)

[13]

Total: 13 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 13 and give them feedback on their performance to prepare them for formal assessment.

Extension/Extension activity

Ask learners to test this circuit with more resistors.

Practical activity 4

Investigate voltage of different resistors in a series

Learner's Book page 138

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Ask learners to set up the circuit in this activity and record their results and answers in their notebooks.

Suggested answers

- 1 Reading 1: individual answer R1
Reading 2: individual answer R2
- 2 Same circuit diagram as in LB. Learners must just write in their voltmeter readings.
- 3 The voltage across a component increases as the resistance of the component increases. A resistor with a higher resistance will have a higher voltage across it. And a resistor with a lower resistance will have a lower voltage across it. A resistor with a higher resistance will transfer more electrical energy into heat energy.

Assessment guidelines

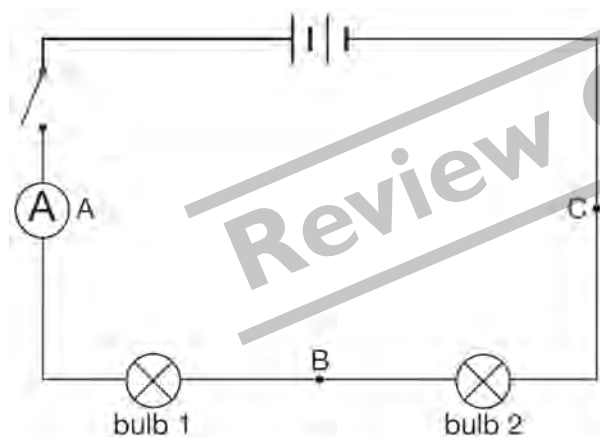
- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Ask learners to share their results with the rest of the class.

Guidelines to implement this activity

- This is a group activity (five learners per group).
- Ask learners to read through the activity and set up the circuits.
- Ask them to record their observations and results in their notebooks.

Suggested answers

- A – two cells in series, ✓✓ two bulbs in series, ✓✓ switch, ✓ ammeter in position A ✓
with reading ✓ (7)
- B – two cells in series, ✓✓ two bulbs in series, ✓✓ switch, ✓ ammeter in position B ✓
with reading ✓ (7)
- C – two cells in series, ✓✓ two bulbs in series, ✓✓ switch, ✓ ammeter in position C ✓
with reading ✓ (7)



Learner's fill in their own readings

Conclusion

The current is the same when measured at any point in a series circuit. ✓ (1)
[22]

Total: 22 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 22 and give them feedback on their performance to prepare them for formal assessment.

Practical activity 6

Investigate more resistors added to a circuit

Learner's Book page 139

Guidelines to implement this activity

- This is a group activity (four learners per group).
- This activity is similar to that carried out in Activity 5 so learners should be confident with setting up circuits correctly and recording their results.

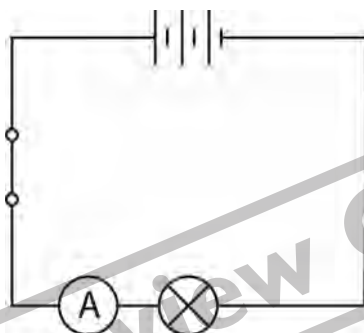
Suggested

A – three cells
switch, ✓

B – three cells
series, ✓✓
reading ✓

C – three cells

✓ with



answers

in series, ✓✓✓ one bulb in series, ✓
ammeter ✓ with reading ✓

in series, ✓✓✓ two bulbs in
series, ✓ ammeter ✓ with

(8)

in series, ✓✓✓, three bulbs in
series, ✓✓✓ switch, ✓ ammeter
reading ✓

Conclusion

The total current decreases with each resistor that is added in series to the circuit. The more resistors connected in series in the circuit, the greater the resistance and the smaller the current. ✓

(1)

[25]

Total: 25 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 25 and give them feedback on their performance to prepare them for formal assessment.

Unit overview

This unit explains how components are connected in parallel in circuits. The effects of connecting more cells in parallel on voltage are described and learners will find out the effects of connecting more resistors in parallel on voltage and current.

Resources

- Three cells of the same voltage, connecting leads, voltmeter, two cells, two resistors such as nichrome wire with different lengths such as 280 mm and 700 mm, switch, ammeters.

Teaching guidelines

Demonstrate to learners, using some examples, how components are connected in series.

Background knowledge

Parallel circuits are more complicated than series circuits and therefore more difficult to troubleshoot if there is a problem. With a parallel circuit, the voltage across each of the components is the same, while the total current is equal to the sum of the currents that go through each component.

Practical activity 1

Measure voltage across cells connected in parallel

Learner's Book page 140

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Read through this activity with the class and help to set up their circuits – check that they have set the circuits up in parallel and not in series.
- Ask them to write their results and conclusion in their notebooks.

Suggested answers

Results

1

Number of cells in parallel	Voltmeter reading (V)	Brightness of the bulb
1	Individual answer✓	bright✓
2	Individual answer✓	bright✓
3	Individual answer✓	bright✓

(6)

2 They were all the same brightness.✓ (1)

3 Combination with three cells. ✓ (1)

4 Voltage will stay the same.✓ (1)

Conclusion

When cells are connected in parallel, the voltage of the combination of cells is the same as the voltage across each individual cell. ✓ (1)

[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

Go over the activity again with learners who are struggling to make sure they understand that the voltage will remain the same irrespective of the number of cells added.

Practical activity 2

Measure voltage across resistors in parallel

Learner's Book page 141

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Instead of using a bulb, as in the previous activity, learners will use resistor wire of different lengths.

- Ask them to set up their circuits, check them and then carry out the experiment, recording their results in their notebooks.

Suggested answers

Results

two cells in series, ✓✓ two resistors in parallel, ✓✓ switch, ✓ voltmeter	(6)
V1 – individual answer ✓	(1)
V2 and V3 – individual answer ✓	(1)
V4 – individual answer ✓	(1)
All the voltmeter readings are the same ✓	(1)
	[10]

Total: 10 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 books with a partner and mark them. Ask them to allocate learners a mark out of 10 to prepare them for formal assessment.

Practical activity 3 Measure current across cells connected in parallel

Learner's Book page 142

Guidelines to implement this activity

- This is a group activity (four learners per group).
- This activity is similar to the two above, except that now learners will measure the current using an ammeter.
- Ask learners to set up the circuit and check that it is correct.
- Ask them to write the observations and conclusions in their notebooks.

Suggested answers

Method

- Prediction - the current will be divided ✓ (1)

Results

- A1 – individual answer ✓, A2 – individual answer ✓, A3 – individual answer ✓ (3)
- Individual answer ✓ (1)
- Yes/no depending on learner's prediction ✓ (1)

- 4 Resistor with low resistance has a larger current✓ and in the resistor with high resistance the current is smaller. ✓ (2)
[17]

Total: 17 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 17 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Revise the results of this activity and re-explain anything that learners do not understand.

Practical activity 4

Measure current when resistors in parallel are increased

Learner's Book page 143

Guidelines to implement this activity

- This is a group activity (four learners per group).
- This activity uses the same circuit as that used in the previous activity.
- Ask learners to write down their results in their notebooks.

Suggested answers

Method

- Circuit diagram with two resistors: two cells in series,✓✓ two pieces of nichrome wire in parallel,✓✓ switch,✓ ammeter✓ with reading✓
- Circuit diagram with three resistors: two cells in series,✓✓ three pieces of nichrome wire in parallel,✓✓✓ switch ✓ammeter✓ with reading✓

Conclusion

The total current in the circuit increases when more resistors are added in parallel.

Assessment guidelines

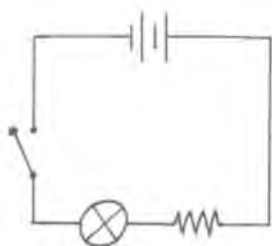
- This activity is intended for informal assessment.
- Use the suggested answers supplied above to assess learners informally. Discuss the results of this activity in class and ask learners to mark their own work. Ask them to make corrections if they have made any mistakes.

Guidelines to implement this activity

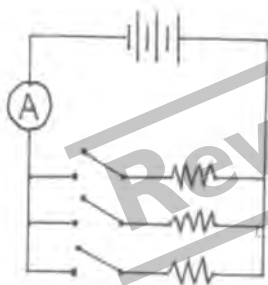
- This is an individual activity.
- By now, learners should have had enough practice to draw their own circuit diagrams. Ask them to draw these circuit diagrams in their notebooks.

Suggested answers

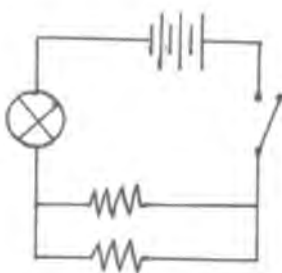
1



2



3



Assessment guidelines

- This activity is intended for informal assessment.

- Use the suggested answers supplied above to assess learners informally. Ask learners to swap their notebooks and mark each other's work. Ask a learner to draw the circuit diagram on the board so that learners can mark the work. Check that all learners have drawn the diagrams correctly by asking for a show of hands of those who drew everything correctly.

Remediation/Remedial activity

Ask learners who drew the diagrams incorrectly, to draw them again in their notebooks.

Unit 10

Series and parallel circuits: Parallel circuits in the home

Learner's Book pages 144–147

Unit overview

This unit explains how lighting systems in the home are parallel circuits. Learners will find out how resistors are used to control current and the relationship between voltage, current and resistance are defined.

Resources

- Two cells, two bulbs, three switches, connecting leads
www.bbc.co.uk/bitesize/standard/physics/using_electricity/useful_circuits/review/1/
- www.bbc.co.uk/learningzone/clips/series-and-parallel-circuits/10597.html

Teaching guidelines

- There are usually many parallel circuits in the home. The reason for this is that if the toaster, hairdryer and television are plugged into the same circuit, all of them receive the same voltage and then when the toaster is unplugged, it will not affect the voltage of the other two appliances plugged into the same circuit.
- Plug a lamp into a wall socket in the classroom and switch it on. Switch the lights in the classroom on and off and ask learners to suggest whether the circuit is connected in series or parallel. Give them a clue by asking how the light that is plugged into the wall socket manages to stay on when their classroom light is switched off.

Practical activity 1**Investigate switching bulbs on and off connected in parallel**

Learner's Book page 145

Guidelines to implement this activity

- This is an individual, pair or group activity (four learners per group).
- Ask learners to set up the circuit and answer the questions in their notebooks.

Suggested answers**Method**

3 All bulbs stop glowing ✓ (1)

Results

1

Position of switches	Appearance of bulbs
All switches closed	All bulbs glow
Switch 1 open, switches 2 and 3 closed	all bulbs stop glowing ✓
Switch 2 open, switches 1 and 3 closed	bulb 1 stops glowing but bulb 2 continues to glow ✓
Switch 3 open, switches 1 and 2 closed	bulb 2 stops glowing but bulb 1 continues to glow ✓

(3)

Conclusion

Lights can be turned off independently and switches can be positioned so that they can turn off one light and all of the lights as in a mains switch. ✓✓ (2)

[6]

Total: 6 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 6 and give them feedback on their performance to prepare them for formal assessment.

Activity 2

Draw circuit diagrams with bulbs in parallel

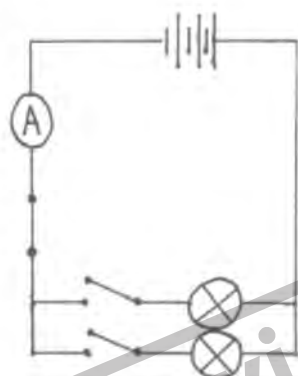
Learner's Book page 146

Guidelines to implement this activity

- This is an individual activity.
- Ask learners to revise the information in this unit and write down their answers in their notebooks.

Suggested answers

2



- Bulbs in parallel, ✓✓ three cells ✓✓ (4)
- 3 Parallel ✓ (1)
- 4 All of the bulbs go out. ✓ (1)
- 5 Only that bulb goes out and the rest continue to glow ✓. This is because there are other paths along which the current can flow. ✓ (2)
- [8]

Total: 8 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 8 and give them feedback on their performance to prepare them for formal assessment.

Guidelines to implement this activity

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

Suggested answers

- 2 Series circuit. All components are connected one after the other.
- 3 Parallel circuit. All components are connected one after the other.

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.

Remediation/Remedial activity

Go over the reason for the answers given above and ask learners who got the answers correct to explain them to those having difficulty.

Unit 11 Safety with electricity: Safety practices

Learner's Book pages 148–153

Unit overview

In this unit, learners find out about parallel connections that can cause overload on mains circuits. Safety devices, such as circuit breakers, fuses and earth leakage systems are explained. They will learn how to wire a three-pin plug and dangerous illegal electrical connections will be discussed.

Resources

- A three-pin plug, three-wire flex cord, screwdriver, sharp knife or wire stripper
- www.youtube.com/watch?v=uOG_75NkHeE
- www.bbc.co.uk/bitesize/standard/physics/using_electricity/from_the_wall_socket/revision/1/

Teaching guidelines

Brainstorm ideas with the class to identify electrical safety practices and devices.

TIP!

Discuss with learners what happens to people who suffer from severe electric shock.

Background knowledge

Many small household appliances are sold with only two point plug attachments. These plugs have the live and neutral wires only, lacking the earth wire. Earth wires in three-point plugs are a safety feature. It is deemed unnecessary to have this safety feature on small appliances which do not draw very large currents.

Activity 1 Identify safety devices in electric circuits

Learner's Book page 151

Guidelines to implement this activity

- This is a class activity.
- Carry out this activity verbally with the class. Ask them for answers.

Suggested answers

Learners identify the fuse, circuit breakers and earth leakage in the circuit breaker.

Assessment guidelines

- This activity is intended for informal assessment.
- Make sure that all members of the class contribute to this discussion. Ask learners to point out where the safety devices are on the diagram.

Activity 2 Draw a plan for wiring a house

Learner's Book page 151

Guidelines to implement this activity

- This is a pair activity.
- Ask learners to write down a list of what is required in the circuit diagram before drawing it out.

Suggested answers

Two-roomed house wiring diagram. Each room must have its own light with a switch. The house must have a mains switch and fuse or circuit breaker to prevent current overload.

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):			
wrote down a list of requirements			
included a light with a switch in each room			
included a mains switch and fuse or circuit breaker			
produced an accurate wiring diagram.			

Extension/Extension activity

Ask learners to include plug points in each room in their wiring diagram.

Practical activity 3 Practise wiring a three-pin plug

Learner's Book page 152

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Ask the class whether anyone has done this before and can give a demonstration to the class before attempting it themselves.
- It is a good idea to attach the plug to an appliance, such as a lamp, to check that it works. However, these plugs must be inspected first by you before they are plugged into the mains electricity supply.

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):			
Connected all three wires in the correct place			
Connected all three wires firmly			
Ensured no uncovered wires were visible outside of the plug			
Checked whether the plug worked.			

Remediation/Remedial activity

For those learners who did not do this correctly, ask them to redo the activity.

Unit 12 Energy and the national electricity grid: Electricity generation

Learner's Book pages 154–155

Unit overview

This unit describes how electricity is made in power stations. Some alternative sources of energy for generating electricity are also discussed.

Resources

- www.bbc.co.uk/learningzone/clips/generating-electricity-from-wind-power/6616.html

Teaching guidelines

Ask learners to go to the library and read up on electricity generation in South Africa.

Background knowledge

The rapidly increasing number of people who are now using electricity in South Africa has put great demand on the power supply. South Africa is heavily reliant on coal as a source of power. There is much discussion at the moment about using alternative sources of energy, such as natural gas harvested from underground (hydraulic fracturing), which is commonly known as fracking. Another alternative is wind power, for which certain sites in the country have been identified as possible regions for energy generation.

Activity 1

Research and compare sources of energy for generating electricity

Learner's Book page 155

Guidelines to implement this activity

- This is a pair activity.
- Take learners to the library and ask them to look up in books and on the internet for information on sources of electricity generation.
- Ask them to make notes so they can generate a complete table as shown in this activity.

Background information

Energy sources include coal, wind, moving water, sunlight, steam, nuclear substances and waves.

Suggested answers

Source of energy for electricity	How long will energy source last?	Effect on the environment
Coal	Limited because coal is a non-renewable resource ✓	Air pollution ✓
Nuclear	Limited because uranium is a non-renewable resource ✓	Problem of waste disposal ✓. If waste material leaks into sea or land it releases radioactivity which is harmful ✓
Flowing water	For ever, provided there is flowing water ✓	Flooding of area to build dams ✓
Solar	For ever ✓	None ✓
Wind	For ever ✓	Noise from turbines ✓. May harm birds ✓

[12]

Total: 12 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 12 and give them feedback on their performance to prepare them for formal assessment
- You can also 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):			
produced a comprehensive list of sources of electricity			
listed how long each energy source would last			
gave comprehensive answers for effects on the environment.			

Extension/Extension activity

Ask learners to find out more details of the process of some electricity generation from some of the less common sources.

Unit 13 Energy and the national electricity grid: Nuclear power in South Africa

Learner's Book pages 156–157

Unit overview

This unit describes the generation of nuclear power. Learners find out about the national electricity grid and how much it costs to generate electrical power.

Resources

- www.bbc.co.uk/bitesize/standard/physics/energy_matters/generation_of_electricity/revision/2/

Teaching guidelines

- Ask learners to read through the information in this unit and then have a discussion about what they have read.
- You can discuss the pros and cons of nuclear power generation.

Background knowledge

One of the most contentious issues to do with nuclear power generation is what to do with the radioactive waste. It is possible that countries that generate power in this way may run out of places where they can store the waste while they wait for it to break down.

Unit 14 Energy and the national electricity grid: National electricity grid

Learner's Book pages 158–159

Unit overview

This unit explains how the national electricity grid distributes electricity throughout South Africa. Power surges and grid overload are also discussed.

Resources

- www.eskom.co.za/c/article/199/understanding-electricity/

Teaching guidelines

- Ask learners to read through the information in this unit and then have a discussion about what they have read.
- Ask learners to discuss issues, such as what they would do without electricity.

TIP!

Make a list on the board of all the things that the school needs for electricity.

Unit 15

Cost of electrical power: The cost of power consumption

Learner's Book pages 160–163

Unit overview

In this unit, learners will find out how electrical power is measured and how much it costs. The power ratings of electrical appliances will be explained. Learners will also find out about appliances and systems that reduce electricity costs.

Resources

- Assorted electrical appliances
- www.eskom.co.za/c/39/careers
www.bing.com/search?q=careers+with+ESKOM&qsn=&form=QBRE&pq=careers+with+eskom&sc=0-15&sp=-1&sk=-#

Teaching guidelines

Ask learners to find out from their parents/guardians how much money they spend on electricity each month.

Background knowledge

The demand on electricity supply in many countries has encouraged the development of many household appliances that are very economical in their power consumption. These include the larger appliances such as fridges, stoves and dishwashers in particular.

Activity 1**Examine power ratings and calculate power consumed**

Learner's Book page 162

Guidelines to implement this activity

- This is a group activity (four learners per group).
- Ask learners to bring some small electrical appliances from home or provide some for them. You can look at some examples in the school, such as the fridge in the kitchen.
- Help them find the power rating on the appliances. Ask them to record their findings and calculations in their notebooks.

Suggested answers

2 Examples given below

Appliance	Power rating (W or kW)	Units of power consumed per hour
1 Kettle	1 kW✓	1 kWh ✓
2 TV set	150 W✓	0.15 kWh ✓
3 Iron	1 kW✓	1 kWh ✓
4 Toaster	800 W✓	0.8 kWh ✓
5 Fridge	500 W✓	0.5 kWh ✓

(10)

3.1 Individual answers (units of power consumed per hour $\div 6$)

Kettle: 0.166 kW✓

TV set: 0.025 kW✓

Toaster: 0.133 kW✓

Iron: 0.166 kW✓

Fridge 0.083 kW✓

(5)

3.2 Individual answers (units of power consumed per hour $\div 2$)

Kettle: 0.5 kW✓

TV set: 0.075 kW✓

Toaster: 0.4 kW✓

Iron: 0.5kW✓

Fridge 0.25 kW✓

(5)

3.3 Individual answers (units of power consumed per hour $\div 60 \times 45$)

Kettle: 0.75kW✓

TV set: 0.1125 kW✓

Toaster: 0.6 kW✓

Iron: 0.75 kW✓

- Fridge 0.375 kW✓ (5)
- 3.4 Individual answers (units of power consumed per hour $\times 2$)
- Kettle: 2.0 kW✓
- TV set: 0.3 kW✓
- Toaster: 1.6 kW✓
- Iron: 2.0 kW✓
- Fridge 1.0 kW✓ (5)
- 4.1 Individual answers ($\text{kW} \times 0.5\text{h} \times 120\text{c}$) ✓ (1)
- 4.2 individual answer ($\text{kW} \times 2\text{h} \times 120\text{c}$) ✓ (1)
- 4.3 individual answer ($\text{kW} \times (3\text{h} \times 30) \times 120\text{c}$) ✓ (1)
- 5 Number of kW pre-paid = $\text{R}200/\text{R}1.20 \text{ per kWh} = 166.7 \text{ kWh}$ ✓
- Time appliance can be used = $166.7 \text{ kWh} / 0.2 \text{ kW}$ ✓
- = 833.5 hours✓ (4)
- [37]

Total: 37 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 37 and give them feedback on their performance to prepare them for formal assessment.

Activity 2

Discuss careers in the energy sector

Learner's Book page 163

Guidelines to implement this activity

- This is a class activity.
- Ask learners to read the information in this unit and then go to the library and look up in books or on the Internet for information on careers in the energy sector.
- Discuss the topic in the classroom.

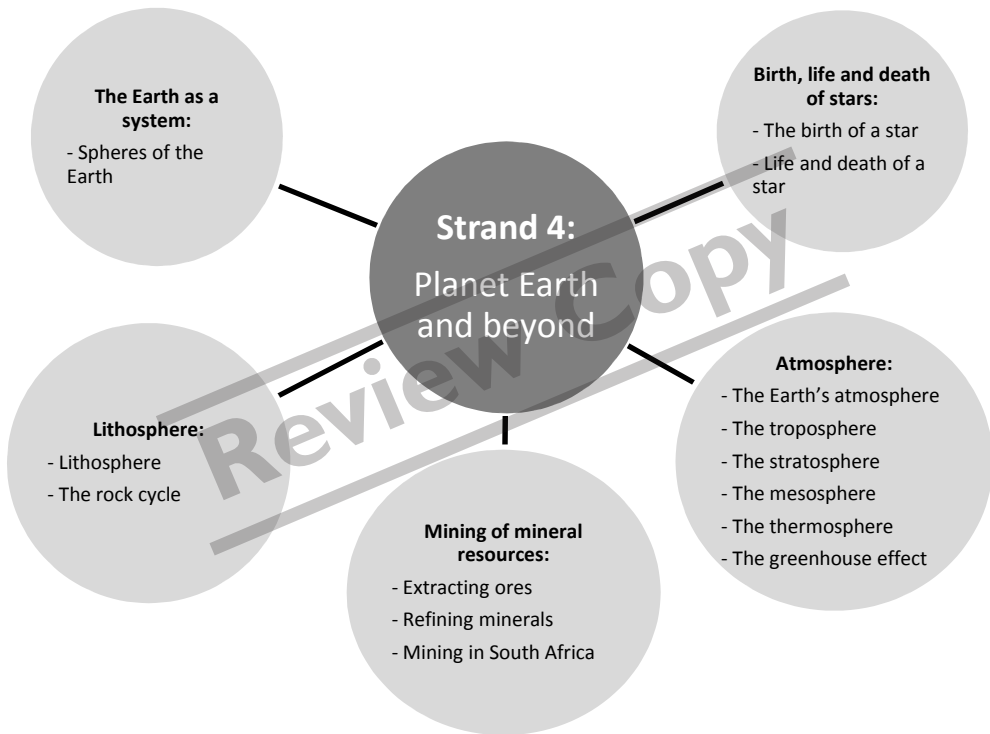
Assessment guidelines

- This activity is intended for informal assessment.
- Make sure that all learners contribute to the discussion

Strand 4

Life and living

Core concepts covered



Strand overview

Unit No.	Content	Pacing (Time allocation)	LB page	TG page
1	The Earth as a system: Spheres of the Earth	3 hours	168	151
2	Lithosphere	3 hours	171	154
3	Lithosphere: The rock cycle	3 hours	174	157
4	Mining of mineral resources: Extracting ores	2 hours	182	162
5	Mining of mineral resources: Refining minerals	2 hours	184	163
6	Mining of mineral resources: Mining in South Africa	2 hours	188	167
7	The Earth's atmosphere	1 hour	192	170
8	Atmosphere: The troposphere	1 hour	194	172
9	Atmosphere: The stratosphere	1 hour	196	174
10	Atmosphere: The mesosphere	1 hour	198	175
11	Atmosphere: The thermosphere	1 hour	199	175
12	Atmosphere: The greenhouse effect	1 hour	200	176
13	Birth, life and death of stars: The birth of a star	1 hour	204	180
14	Birth, life and death of stars: Life and death of a star	2 hours	206	181

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	Make a model of the greenhouse effect	200	177	Assessment table (20)	177
Project	Investigate how South Africa contributes to global warming	210	183	Assessment table (50)	183
Controlled test	Exemplar test	211	192	Memorandum (40)	192
Controlled test	Exemplar end-of-year exam	213	193	Memorandum (80)	193

Unit 1 The Earth as a system: Spheres of the Earth

Learner's Book pages 168–171

Unit overview

The Earth is a complex system where all the parts (called spheres) interact with each other. The four spheres of the Earth are the lithosphere (solid crust), the hydrosphere (water), the atmosphere (gases surrounding the Earth) and the biosphere, which is where all living things exist.

Resources

- Spheres of the Earth
www.youtube.com/watch?v=dgU282cBWdo
- Earth Science - The four layers and spheres of Earth
www.youtube.com/watch?v=uG3ql0vLioU

Teaching guidelines

- In earlier grades, learners were taught about the Earth being the only planet that can support life. This unit will build onto their prior knowledge.
- The content should be explained with reference to the diagrams and pictures. Repeat and explain the new terminology often.
- Show the video clips to the learners as it will help them to understand the concept of interaction of the spheres of the Earth.
- If you do not have a computer in your class, take them to the media centre or ask them to watch the video clips at home. Any pictures from books or magazines are helpful for learners to learn about the Sun.
- Invite all learners to take part in discussions and Q & A sessions and ensure that everyone has a chance to contribute throughout the course of this unit.

Background knowledge

- This unit builds on knowledge gained in previous grades about the components making up the Earth.
- These components are now grouped into four spheres, the names of which learners have not encountered before.

Remediation/Remedial activity

Make a wall chart with a mind map of the names and components of the four spheres. Display for the duration of this topic, referring to it often during lessons.

Activity 1 Identify things on the satellite image

Learner's Book page 169

Guidelines to implement this activity

- This is an individual activity and serves as an introduction to the topic.
- Ask the questions and write learners' answers on the board.

Background knowledge

- Learners have seen and discussed photographs of the Earth from space in previous grades.
- The names of continents and oceans were done in the intermediate phase and learners should be able to identify the different parts.

Suggested answers

1. Africa and Antarctica
2. Indian and Atlantic
- 3.1 Clouds
- 3.2 The atmosphere

TIP!

Explain that Europe and Asia are sometimes called Eurasia.

Australia is sometimes called Australasia when referring to the continent and all of the islands around it.

These answers represent three of the Earth's spheres: lithosphere, hydrosphere and atmosphere, which learners will learn about during this term.

Assessment guidelines

- This activity is intended for informal baseline assessment to determine the learners' existing knowledge on the components of the Earth.
- Ask these questions again throughout this unit to consolidate the names of the continents and oceans.

Guidelines to implement this activity

- This is an individual activity.

Background knowledge

In this activity learners consolidate what they have learnt in the unit and apply this knowledge to answer the questions.

Suggested answers

- 1 The hydrosphere provides water vapour for the atmosphere. ✓ (1)
 - 2 The lithosphere provides a rock base for the water of the hydrosphere. ✓ (1)
 - 3 The atmosphere provides oxygen and carbon dioxide that living things in the biosphere need. ✓ (1)
 - 4 The lithosphere provides soil that plants in the biosphere need. ✓ (1)
 - 5 The hydrosphere provides water that all living things in the biosphere need. ✓ (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.

Remediation/Remedial activity

Write the model answers on the board for learners to do corrections in their notebooks.

Extension/Extension activity

Ask the more competent learners to do research on any recent disaster and its impact on the other spheres of the Earth, for example Hurricane Sandy in the USA. They can explain it to the rest of the class in the next lesson with images and pictures.

Unit overview

The Earth consists of concentric layers called the inner core, outer core, mantle and lithosphere. The lithosphere consists of the rocks of the crust and the soil. The main elements in the Earth's crust are silicon and aluminium. Towards the core the main elements are the metals iron and nickel.

Resources

- Inside Planet Earth - Discovery Channel [HD]
www.youtube.com/watch?v=oR4Pb0ovVLU
- Earth - One video you NEED to see
www.youtube.com/watch?v=thuViaxRd_w&feature=related

Teaching guidelines

Show the learners the video clips referred to above. You can use any other applicable pictures and model of the Earth (globe).

Background knowledge

- This unit ties in with the work that the learners have done in Grade 7 on the inside structure of the Earth.
- All the knowledge on metals and their properties serves as a backdrop to the content in this unit.

Activity 1 Summarise information about the Earth's structure in a table and a diagram

Learner's Book page 172

Guidelines to implement this activity

- This is an individual activity.
- Ask the learners to re-read the information in this unit and then carry out this activity.
- Learners copy and complete the table in their notebooks.
- Go through answers in class.

Suggested answers

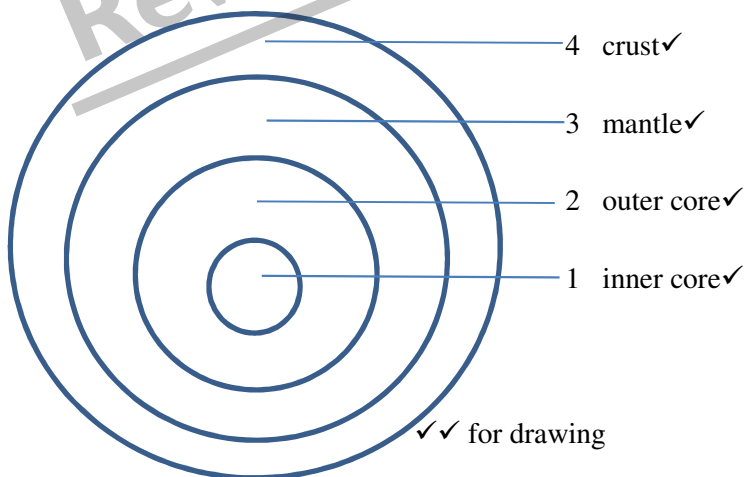
1

Layer name	Thickness	Temperature	Consistency (molten or solid)	Other characteristics
Inner core	2 440 km✓	7 000 °C✓	Solid✓	Iron and nickel✓
Outer core	2 250 km✓	4000 °C✓	Molten✓	Dense metallic rocks✓
Mantle	2 900 km✓	1000 °C✓	Molten✓	Plastic consistency which allows it to flow✓
Crust	6 and 90 km✓	Temperature decreases nearer to the surface✓	Solid✓	Least dense layer✓

[16]

- 2 Learners must draw concentric circles to represent a simple cross section through the centre of the Earth. Label the layers 1-inner core, 2-outer core, 3-mantle, 4-crust.

LAYERS OF THE EARTH✓



[7]

Total: 23 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Learners mark each other's work from suggested answers.
- They assign a mark out of 23 and record their marks in an assessment table at the back of their notebooks.

Remediation/Remedial activity

Drawing skills are required by learners in Natural Science. If learners make too many mistakes, show them how to improve their drawings and ask them to redo them for the next lesson. Re-assess their work and congratulate them if they have improved.

Extension/Extension activity

If learners have access to the internet after school, they can add more information in the table about the different layers. The information can be shared with the class during the next lesson.

Activity 2

Read about and research what elements and compounds we get from the crust

Learner's Book page 173

Guidelines to implement this activity

- This is an individual activity.
- Learners need to read the information and do research about which elements and compounds appear in the Earth's crust.

Suggested answers

- 1 Oxygen, ✓ silicon ✓ and aluminium. ✓ (3)
- 2.1 Diamond, ✓ graphite (carbon element), ✓ mercury, ✓ silver, copper (any three) (3)
- 2.2 The elements present in the minerals feldspar and mica: silicon, ✓ oxygen, ✓ aluminium, ✓ potassium, ✓ magnesium, ✓ iron, ✓ hydrogen. ✓ (7)
- 2.3 The chemical formulae for feldspar: $AlSi_3O_8$ ✓ (1)
The chemical formulae for mica: $K(Mg,Fe)AlSi_3O_{10}(OH,F)_{12}$ ✓ (2)
- 2.4 The elements present in limestone: calcium, ✓ carbon ✓ and oxygen; ✓ and the elements present in clay: silicon, ✓ oxygen, ✓ hydrogen, ✓ iron, ✓ calcium and sodium. ✓ (9)

Total: 30 marks

Assessment guidelines

- This activity is intended for informal assessment.

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

Criteria	Yes	Partly	No
The learner(s):			
followed the instructions in the Learner's Book and understood what to do without help			
learner made an effort to research the required material and managed to find sufficient facts			
learner was able to find all the answers to the questions.			

Remediation/Remedial activity

Assist learners that have no access to the internet with information. It is important that they process the information themselves.

Extension/Extension activity

Ask learners to paste pictures of products made from some of the minerals and elements in their books with appropriate captions.

Unit 3 Lithosphere: The rock cycle

Learner's Book pages 174-181

Unit overview

The rock cycle describes the continuous cycle of events of formation of igneous rocks, weathering and erosion, deposition of sediments, formation of sedimentary rocks, and formation of metamorphic rocks.

Resources

- Examples of igneous, metamorphic and sedimentary rocks:
<http://geology.com/rocks/>
- Wonderful website with images of hundreds of rock types
<http://www.learner.org/interactives/rockcycle/types.html>
- Types of rocks
<http://www.youtube.com/watch?v=oR4Pb0ovVLU>
- Inside Planet Earth - Discovery Channel [HD]
http://www.youtube.com/watch?v=thuVixRd_w&feature=related
Earth

Teaching guidelines

- This unit is best taught with rock samples of the different types of rock. Start a collection of rocks in your classroom and add to them all the time. Use reference books and the unit in the Learner's Book to identify the rocks.
- The rock cycle needs to be explained on the board or from the diagrams in the Learner's Book. It is important that learners understand that the rock cycle is a continuous event, though it happens very slowly.

Background knowledge

In earlier grades, learners have studied: rocks, the formation of sedimentary rock and the uses of sedimentary rocks, and should be familiar with the work.

TIP!

Learners are usually very eager to bring rock samples to class. Most of them will probably be crystals or polished semi-precious stones. These are sometimes difficult to class into types of rock. Use the websites listed in resources section, which have lots of rock samples, to identify their samples. Print the pages with captioned images and laminate to put up in the classroom.

Remediation/Remedial activity

Provide books, posters and other media in class with information about different rocks

Extension/Extension activity

Ask the learners to find out what kind of job a geologist, archeologist, paleontologist and an environmentalist does, and what they all have in common.

Activity 1

Identify igneous rocks

Learner's Book page 175

Teaching guidelines

- This is a pair activity.
- Learners work together to identify the rocks.
- They record their answers in their notebooks.

Suggested answers

- 1 They are crystalline, they have no layers. ✓ (1)
- 2 A, ✓because the crystals are large and they must have cooled down slowly. ✓ (2)
- 3 B, ✓because the crystals are too small to see with the naked eye. This rock must have cooled down quickly on the surface of the Earth. ✓ (2)
- 4 Oxygen ✓and silicon. ✓ (2)

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 7 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Provide the correct answers to those learners whose work is incorrect, so that they can do the corrections.

Practical activity 2

Make a model of sedimentary rocks

Learner's Book page 177

Guidelines to implement this activity

- This is a group activity.
- Ask learners to re-read the section in the Learner's Book on p. 177
- You will need a sliced loaf of white bread and a sliced loaf of brown bread. Divide the slices between the groups.
- They may use water to mould the bread and whatever they can find to represent extra layers, such as newspapers, tissues, pencil sharpenings, etc.
- They should explain the process to each other while they work.

TIP!

Bring a sandwich to school with layers of cold cuts, tomato, cheese, avocado, boiled egg. Show it to the learners before they start moulding the bread.

Assessment guidelines

- This activity is intended for informal assessment. Groups make their model and show it to other groups, explaining its properties.
- No marks are awarded as this is a practical activity for enjoyment.

Activity 3

Investigate and classify different rocks

Learner's Book page 179

Guidelines to implement this activity

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

- Show learners a brick and a piece of reinforced concrete, so that they don't make the mistake of thinking these are natural rocks.
- If you know of a suitable place near your school where rocks are exposed, such as a road cutting, direct learners to this area.
- Each learner studies at least four samples. They should look for rocks that differ in appearance.
- Provide learners with a copy of the table below to record their findings.

Background knowledge

Learners should have a thorough understanding of the content in this unit.

Suggested answers

3 and 4 Learners complete the table and paste in their notebooks.

Criteria	Sample 1	Sample 2	Sample 3	Sample 4
3.1 Colour?				
3.2 One colour or several?				
3.3 Mottled/ spotted appearance?				
3.4 Does the rock consist of grains stuck together? Big or small pieces?				
3.5 Are the grains/pieces the same size or many different sizes?				
3.6 Can you see shiny crystals in the rock?				
3.7 Does the rock have lots of layers?				
4. Classify as sedimentary, igneous, metamorphic rock.				

5 A, sedimentary, B, igneous, C metamorphic

Assessment guidelines

- This activity is intended for informal assessment.
- Learners' answers will differ. Ask group leaders to check each member's classification.
- There is no mark allocation for this observation and identification activity.

Remediation/Remedial activity

Assist learners with rock identification if required.

Extension/Extension activity

Advanced learners could find pictures or samples of very scarce rock or rocks that are used for jewellery. They can show and explain them to the class.

Activity 4

Interpret and draw a diagram of the rock cycle

Learner's Book page 180

Guidelines to implement this activity

- This is an individual activity.
- They must also draw a diagram and label it in the correct sequence. They do the activity in their notebooks.

Background knowledge

The diagram of the rock cycle is in the Learner's Book on page 181.

Suggested answers

- 1 The events take place in a continuous circle.✓ (1)
- 2 Igneous rocks ✓ (1)
- 3 Granite, ✓basalt ✓ (2)
- 4 Weathering ✓and erosion.✓ (2)
- 5 When molten magma forces itself into the crust and the surrounding rocks are affected by heat and pressure.✓ (1)
- 6 Marble, ✓quartzite ✓and slate✓ (3)
- 7 See diagram in LB✓ mark for each of the 10 labels if in correct sequence. (10)

Total: 20 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 20 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Provide the class with the model answers above to correct their work.

Unit 4 Mining of mineral resources: Extracting ores

Learner's Book pages 182-183

Unit overview

Some metals and minerals exist in their native form as compounds of single elements, such as diamonds. But most metals and minerals exist as ores, which are mined by open-cast or shaft mining. Rock that contains high concentrations of a valuable mineral is called ore. Some minerals can be used in their natural form, such as sand, potash and diamonds. Others have to be refined to extract the minerals from the ore.

Resources

- Steel: From start to finish

www.youtube.com/watch?v=9l7JqonyoKA

- Iron ore mining process flow chart

www.youtube.com/watch?v=9dNcKmRqr8A

- Smelting steel

www.youtube.com/watch?v=mprtHmEzXjI

- Geography - Lithosphere: Mineral Resources of the Lithosphere

www.youtube.com/watch?v=e0EyZS5rfOU

Teaching guidelines

- It is important that learners understand the value and the process of extracting ore.
- If you have a computer or white board in your classroom you can show them the video clips as an introduction to the lesson. You can repeat some of the video clips at the end of the unit.

Background knowledge

The learners have studied minerals and compounds already, so they have some knowledge of minerals and their properties. As an introduction to the lesson you can revise some of these properties with them, for example: shiny, malleable, conduction of heat and electricity, hard, strong.

Remediation/Remedial activity

This is mostly new material and educator should ensure that all the learners grasp the concepts. Ask questions and explain again if learners seem unsure.

Guidelines to implement this activity

- This is a group or class activity.
- Show the video clip (link below) of how to pan gold. (7 minutes)
- Take the learners outside to practise the panning.

Assessment guidelines

- This activity is intended for informal assessment.
- No marks are awarded, as it is a practical activity for enjoyment.

Unit 5 Mining of mineral resources: Refining minerals

Learner's Book pages 184–187

Unit overview

Ores are refined using chemical and physical processes. Long ago people heated the ore until the metal melted. Today we use physical separating methods, such as gold refining, and chemical methods, such as blast furnaces for refining iron ore.

Resources

- Steel: From start to finish
www.youtube.com/watch?v=9I7JqonyoKA
- Smelting steel
www.youtube.com/watch?v=mprtHmEzXjI
- Reduction of lead oxide
www.youtube.com/watch?v=Eh8Ll4_xac
- Lead into gold - your basic alchemy
www.youtube.com/watch?v=PAFzq111ZIE

Teaching guidelines

- The knowledge that iron and copper extraction is thousands of years old is an important cultural achievement for people in South Africa. Show learners extra pictures and materials of the tools that have been used. Many museums in the country have some of these tools on display. Arrange a class visit or encourage the learners to visit the museum in their free time.

Background knowledge

Learners should by now have sufficient background knowledge from previous units to understand the content of this unit.

Activity 1 Compare old and modern ways of smelting iron ore

Learner's Book page 185

Guidelines to implement this activity

This is a pair activity. Learners discuss and complete the answers in their notebooks.

Suggested answers

- 1 In the old Iron Age smelter they used charcoal and iron ore, ✓ and in the modern blast furnace they use iron ore, coke and limestone. ✓ (2)
- 2 Probably by trial and error. ✓ Once somebody had done it successfully they would have spread the news to others. ✓ (2)
- 3 It is contained ✓ and the ore is heated to a much higher temperature. ✓ (2)
- 4.1 the iron ore – iron oxide ✓ (1)
- 4.2 the coke – carbon ✓ (1)
- 4.3 the metal – iron ✓ (1)
- 4.4 the waste gas – carbon dioxide ✓ (1)
- 5 The moulds are called pigs. ✓ (1)

Total: 11 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Learners assess their work from the suggested answers below.
- They award their work a mark out of 11 and record it in their own assessment table in their books.

Practical activity 2 Demonstrate how lead is extracted

Learner's Book page 186

Guidelines to implement this activity

- This is a class activity – demonstration is done by the educator.
- **WARNING!** Only do this activity in a fume cupboard in a well-ventilated room.
- **ALL LEARNERS MUST WEAR SAFETY GLASSES.**

- Copper oxide can be used instead of lead oxide for this experiment.
- Use the same amounts of copper oxide and charcoal and do not mix them in the test tube. Proceed as with the lead oxide.
- Explain the experiment to the learners beforehand and ensure that they fully understand how to behave during demonstrations with harmful chemicals.
- Lead is TOXIC and DANGEROUS to the environment.

TIP!

If you do this demonstration, it is important that the test-tube is dry. Heating lead and its compounds strongly in glass often results in the lead compounds fusing into the glass, so the test-tube will be impossible to re-use. You could use old, but unstained test-tubes and throw them away afterwards.

Assessment guidelines

- This is a demonstration by the educator. Learners will be informally assessed.
- Learners have to observe closely during the experiment.
- They describe the experiment in their notebooks and record the reactions in words and symbols.
- Assess with the checklist below and warn learners beforehand of its content.

Criteria	Yes	Partly	No
The learner(s):			
was well behaved and attentive during the demonstration			
made an effort to find out more about the process and asked insightful questions			
was able to find and correctly record the reaction.			

Results and conclusions

- 1 Yes✓
 - 2 Lead oxide + carbon → lead + carbon dioxide✓
 - 3 $2\text{CuO(s)} + \text{C(s)} \rightarrow 2\text{Cu(s)} + \text{CO}_2\text{(g)}$ ✓
- Copper oxide + carbon → copper + carbon dioxide✓

Activity 3

Read about how metal is extracted from ore

Learner's Book page 187

Guidelines to implement this activity

- This is an individual activity. Learners read the case study and answer the questions in their notebooks.

Suggested answers

- 2 All learners will have seen aeroplanes in the sky – these have to be built of strong, but very lightweight, non-corrosive metal so that they can lift off the ground. Cooldrink cans made of aluminium are light, do not corrode and are easy to crush for recycling. Aluminium foil used to wrap food is hygienic and strong.
- 3 1. Bauxite is purified to produce aluminium oxide → 2. Aluminium oxide is dissolved in molten cryolite and heated to make molten → 3. Electrolysis tank → 4. Aluminium metal forms at the negative electrode and sinks to the bottom of the tank, where it is tapped off.
- 4 Australia's electricity is too expensive to make it economically viable.
- 5 Aluminium recycling: Like all metal ores, bauxite is a non-renewable resource. Although there are known supplies of bauxite to last for at least another hundred years, there will come a time when it runs out. Recycling is therefore a way of making this resource sustainable. Recycling aluminium is easier than recycling other metals because aluminium melts at about 666°C compared to 1500°C for steel. Aluminium can be recycled again and again. Recycled aluminium is produced with only about 5% of the energy needed to extract the metal from bauxite. People earn money by collecting scrap aluminium for recycling. More and more businesses are returning scrap aluminium, such as motor car parts.

Assessment guidelines

- Assess learners' answers according to the suggested answers above.
- Give feedback to learners in preparation for formal assessment.

Remediation/Remedial activity

Copy the model answers for the learners to paste in their notebooks. Those learners with poor results could be tutored after school.

Extension/Extension activity

Advanced learners can do research about the location and sustainability of iron ore in South Africa. They can tell the class about it as an introductory activity to Unit 6.

Unit 6 Mining of mineral resources: Mining in South Africa

Learner's Book pages 188-191

Unit overview

South Africa has rich resources of many minerals. Although the revenue earned from these minerals is substantial, the price paid by the environment is not always calculated beforehand. Mining causes environmental problems, such as mine dumps, pollution of water resources, damage to places with high tourist and cultural heritage value, and loss of farming and wild life environments.

Resources

- Gold mining

www.youtube.com/watch?v=MaSH70Vc4e4

- Smelting iron from iron ore

www.youtube.com/watch?v=W6uFAv9L734

- polluted-water_news

- Pollution of water in Carolina by mine waste

www.dailymotion.com/video/xsmpwc_s-africans-sue-government-over-

- Rising of acid mine water from gold mines

www.youtube.com/watch?v=EOLf6tJju8A

Teaching guidelines

- Mining is done on a large scale in South Africa – it is part of the economic development in South Africa.
- A lot of people are employed at the mines, but it is important to emphasise that more and more is done by government legislation to force mines to prevent pollution to the environment.

Background knowledge

Scientific knowledge about metals and practical work done with metals will help learners in this section.

Activity 1**Find out about mining in your province**

Learner's Book page 189

Guidelines to implement this activity

- This is a pair activity.
- Learners answer the questions in their notebooks.

TIP!

Learners can interpret the symbols on the map of their province and answer the questions. If your province has no minerals, learners can choose any other province to answer the questions.

Suggested answers

- 1 Answers will depend on which province you are in.
- 2 Answers will depend on which province you are in.
- 3 Work opportunities in mines and factories, and also in the service industries that support them
- 4 Air pollution, water pollution, leaving scars of old mines on the landscape, mine dumps.
- 5 Answers will depend on which province you are in. For example, gold and platinum earn foreign currency through exports. Iron ore is used to make steel in South Africa, which is much cheaper than importing it from other countries. Coal is used to generate electricity. South Africa's electricity is mainly dependent on thermal power stations, which use coal.

Assessment guidelines

This is an informal activity.

Assess the learners' answers according to the suggested answers above.

Remediation/Remedial activity

Provide the model answers so that learners can do corrections.

Extension/Extension activity

Learners who have completed their work can be sent to the library to assemble at least ten interesting facts about any precious metal or stone mined in South Africa.

Advanced learners can research and write a report about a day in the life of a coal miner.

Activity 2**Research a mining activity in South Africa**

Learner's Book page 191

Guidelines to implement this activity

- This is an individual activity.
- Learners do research in the library or on the internet about any mineral mined in South Africa.

They process their information and write a report of about one page in their notebooks about their findings. Marking scheme:

Criteria	Maximum marks allocated
Report written in learner's own words, typed or neatly written.	4
Report has a cover page with learner's name and project title on it.	1
Report has a contents page with headings and page numbers.	1
Report has three to four pages of content excluding the cover, contents and bibliography pages.	1
Report has a bibliography listing of at least three references used.	1

Content:

Criteria	Maximum marks allocated
Clear information on:	
Elements and compounds being mined	6
Method of mining	4
Chemical and physical separation methods used to refine the mineral	6
Environmental impact	6
Relevant illustrations included	10

[40]

Total: 40 marks**Assessment guidelines**

- This is an informal activity.
- Assess learners' reports according to the marking scheme above.

Remediation/Remedial activity

Learners who wrote exceptional reports may read them aloud in class. Ask their permission to copy their reports as an example for struggling learners.

Extension/Extension activity

Challenge those learners with exceptional reports to compile at least five suggestions about how the environmental impact of the mining they wrote about could be successfully lessened.

Unit 7 Atmosphere: The Earth's atmosphere

Learner's Book pages 192-193

Unit overview

The atmosphere is a mixture of gases, mainly nitrogen and oxygen. It is a relatively thin layer of air held in place by the Earth's gravity. There are four layers in the atmosphere, each with its own properties.

Resources

- Earth's Thermosphere-Mesosphere-Stratosphere-Troposphere
www.encyclopedia.com/video/EJC-gHA3O-c-earths-thermospheremesospherestatospheretroposphere.aspx
- Mysteries of the Sun pt 5/5 - Ionosphere Troposphere and Mesosphere
www.youtube.com/watch?v=NnCvph9m9B4

Teaching guidelines

- This unit is an extension of Planet Earth done in Grades 7 and 8.
- You can introduce the lesson by asking learners to interpret and describe the features of the different layers seen in the video clips.

Background knowledge

Revise the principles of gravity and the attraction between different bodies, as learners have done them in Grades 7 and 8.

Activity 1 Interpret a graph showing layers of the atmosphere

Learner's Book page 193

Guidelines to implement this activity

- This is an individual activity.

TIP!

This is an excellent activity for interpreting a graph, recording answers on a table and graph drawing.

Follow the tips below if learners need help with drawing their own graph.

Suggested answers

1

Layer	Height (km)	Temperature at bottom of layer (°C)	Temperature at top of layer (°C)
Troposphere	10✓	25✓	-50✓
Stratosphere	50✓	-50✓	0✓
Mesosphere	87✓	0✓	-90✓
Thermosphere	160✓	-90✓	500✓

(12)

2.1 Temperature decreases with height. ✓ (1)

2.2 10km above the Earth's surface. ✓ (1)

2.3 25 °C✓ (1)

2.4 The stratosphere ✓ and the thermosphere. ✓ (2)

2.5 -90 °C. ✓ At top of mesosphere/beginning of thermosphere. ✓ (2)

2.6 Temperature increases with altitude in the thermosphere. ✓ (1)

3.1-4 Learners draw a graph according to the instructions.

- Four layers labelled. ✓✓✓✓
- Four temperatures labelled ✓✓✓✓
- Temperature scale ✓✓
- Altitude scale ✓✓
- Temperature gradient ✓✓
- Heading. ✓✓

(16)

Total: 30 marks

Assessment guidelines

- This activity is intended for informal assessment.
- Learners assess their own work according to the memorandum above.
- Use the suggested answers supplied above to assess learners informally. Allocate learners a mark out of 30 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

Provide an opportunity after the assessment for learners to ask questions about work that they do not understand. Practise drawing graphs with those learners who are struggling with them.

Unit 8 Atmosphere: The troposphere

Learner's Book pages 194-195

Unit overview

In this unit, the four different layers of the atmosphere will be discussed in more detail. The troposphere extends from the Earth's surface to 10 km above. It is the most-dense layer, temperature decreases with altitude. It contains water vapour, which allows for weather to occur and plants and animals to live in this layer.

The stratosphere extends from 10km-50 km above the Earth. Air is much thinner and there is a layer of ozone in this layer.

The mesosphere extends from 50km-80 km with very thin, cold air. Meteors occur in this layer.

Resources

- Views from low Earth orbit

www.youtube.com/watch?v=jlNEHKpQyio

- Earth at night seen from space ISS (HD 1080p) ORIGINAL

www.youtube.com/watch?v=ev9oPUNaqXE

Teaching guidelines

- This section follows on from the section of the Earth's atmosphere where all the different layers were discussed very briefly.
- Make use of diagrams and/or models for this section.
- Show learners the video clips referred to in the section above, it will help them understand this section easier.

Background knowledge

Learners must understand that if the distance from the Earth's surface increases, the air temperature, the density of the atmosphere and air pressure changes. In some layers it will decrease, in others it will increase.

Activity 1

Calculate the temperature at different altitudes

Learner's Book page 194

Guidelines to implement this activity

- This is an individual activity.

- Go through the example in the Learner's Book. Learners will have to understand the principle of 1°C drop in temperature for every 100m risen. Assume that the air is still; thus no wind or precipitation.

Suggested Answers

Mountain (country)	Altitude	Temperature at base	Temperature at top
Mt Everest (Nepal)	8848m	15°C	$8848 \div 100 = 88$ and $+15^{\circ}\text{C} - 88^{\circ}\text{C} = -73^{\circ}\text{C}$ ✓ for every step (3)
Mt Kilimanjaro (Kenya)	5895m	25°C	$5895 \div 100 = 59$ and $+25^{\circ}\text{C} - 59^{\circ}\text{C} = -34^{\circ}\text{C}$ (3)
Matterhorn (Switzerland)	4478m	18°C	$4478 \div 100 = 45$ and $+18^{\circ}\text{C} - 45^{\circ}\text{C} = -27^{\circ}\text{C}$ (3)
Mt Fuji (Japan)	3776m	10°C	$3776 \div 100 = 38$ and $+10^{\circ}\text{C} - 38^{\circ}\text{C} = -28^{\circ}\text{C}$ (3)
Mt Robson (USA)	3954m	12°C	$3954 \div 100 = 40$ and $+12^{\circ}\text{C} - 40^{\circ}\text{C} = -28^{\circ}\text{C}$ (3)

[15]

Total: 15 marks

Background knowledge

Learners will make use of their mathematical knowledge to answer the questions.

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 15 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

If learners struggle to do the calculations, show them the steps in the calculation and let them try again.

Extension/Extension activity

Advanced learners can find out about high South African and African mountains and work out what the temperature will be at the top of these mountains if the base temperature is 25°C .

Unit 9 Atmosphere: The stratosphere

Learner's Book pages 196-197

Unit overview

The stratosphere extends from about 10 km to about 50 km above the Earth's surface. The air in this part of the atmosphere is very thin, and aeroplanes flying as high as this need to be pressurised to enable the passengers to breathe. Included in the stratosphere is a band of ozone gas, which absorbs ultraviolet rays from the Sun. In the troposphere, air temperature decreased with height. The opposite is true for the stratosphere, where air temperature increases with height. The ozone layer serves as a barrier between Earth and the ultraviolet rays from the Sun. Without it, life on Earth would not have been possible.

Resources

- Video about ozone layer
www.nasa.gov/topics/earth/features/ozone-history.html
- Visual material showing the four layers of our atmosphere
archive.org/details/CIL-10015

Teaching guidelines

- Show the video clips above to the learners to give them an idea of the range of the stratosphere.
- Discuss the ozone layer, its composition and function in detail.
- Lead a question and answer session about the changes to the ozone layer, its causes and what is being done about it. What would the long term effect be on life on Earth if the ozone layer ceased to exist?

TIP!

As an introduction to this unit, the learners could be asked about the highest mountain in the world. Mount Everest in the Himalayans, Nepal, is the highest at 8859 m. This means that there is no part of the Earth's surface present in the stratosphere. The only human life occurring there is some aeroplanes and astronauts.

Background knowledge

Useful information and pictures can be found at:
www.encyclopedia.com/topic/stratosphere.aspx

Unit 10 Atmosphere: The mesosphere

Learner's Book page 198

Unit overview

The mesosphere is about 30 km thick and extends from a height of 50-80 km above the Earth's surface. There is nothing in this layer to trap the heat of the Sun; therefore the air is extremely cold and thin. This layer is responsible for the 'shooting stars' we see from Earth. Rocks entering this layer burn up, showing a bright tail in the sky.

Resources

- Interesting facts about the mesosphere
www.windows2universe.org/earth/Atmosphere/mesosphere.html

Teaching guidelines

- Learners should understand that this is the third layer of the atmosphere from Earth.
- No natural life is possible in this layer.
- It acts as a shield burning up rocks and space dust entering it.

Background knowledge

Make an effort to read up about the different layers to present the learners with interesting detail to grab their attention.

Unit 11 Atmosphere: The thermosphere

Learner's Book page 199

Unit overview

This layer extends from about 80 km to 350 km above the Earth's surface. Beyond this is the exosphere or space. The lowest part of the thermosphere enables us to listen to the radio and watch TV, to find our way via GPS and to communicate with each other with cellphones.

Resources

- Interesting facts about the thermosphere

spark.ucar.edu/shortcontent/thermosphere-overview

- How do satellites work?

www.youtube.com/watch?v=yxYzjHBKNcA

Teaching guidelines

- The focus in this unit will be on satellites, the International Space station and other manufactured objects orbiting the Earth in or just above the thermosphere.
- Explain that the thermosphere absorbs ultraviolet radiation from the Sun, but also reflects radio signals back to Earth.

Unit 12 Atmosphere: The greenhouse effect

Learner's Book pages 200-203

Unit overview

The greenhouse effect warms the atmosphere sufficiently to sustain life. Greenhouse gases, such as CO₂ trap ultraviolet radiation, which heats the atmosphere more and leads to global warming. This can lead to disasters, such as flooding, increase of deserts, food shortages and mass extinctions.

Resources

- Greenhouse effect and Global warming
www.youtube.com/watch?v=dP-tg4atr5M
- Global warming - A video by NASA
www.youtube.com/watch?v=ab6jV4VBWZE
www.youtube.com/watch?v=xcVwLrAavyA
- Discovery Channel - Global warming, what you need to know, with Tom B
www.youtube.com/watch?v=wnb20chqbxM

Teaching guidelines

- It is important that learners understand the principle of the greenhouse effect. Make use of models and posters to explain this concept.
- Learners need to visualise the greenhouse effect to enable them to understand it.

Background knowledge

- Learners have been introduced to this topic several times in earlier grades. Ensure that they know exactly what it entails, as it can be confused with global warming.

Guidelines to implement this activity

- This activity is a pair activity for formal assessment.
- Learners work with a partner, but they must write up their results and conclusions in their notebooks individually.

Learners should do some research on the greenhouse effect in addition to the text on page 200.

Suggested answers

- 3 Make sure your model is a fair test to compare the temperature of the so-called greenhouse and the normal situation. Points to look for:
Did they use exactly the same sized glass jars?
Did they put exactly the same amount of cold water and/or ice cubes in each jar?
Did they leave the jars in the same warm place for the same length of time?
Did they use the same thermometer to measure the temperature of the water in each jar?
- 4 Record results.

Results and conclusion

- 1 It shows that if an area is covered with a material that allows the heat and the light of the Sun through, that area will be warmer than one with no cover.
- 2 See 3 above.

Use this assessment table to assess pairs:

How well did you:	Excellent	Good	Average	Requires intervention
Work together sharing tasks and supporting each other?	4	3	2	1
Design a fair test?	4	3	2	1
Collect and use suitable materials?	4	3	2	1
Measure temperatures accurately?	4	3	2	1
Tidy up afterwards?	4	3	2	1

[20]

Total: 20 marks

Assessment guidelines

- This activity is intended for formal assessment and is a practical activity.
- Assess each pair according to the suggested answers and assessment table above.
- Record the marks under practical tasks and provide the learners with feedback afterwards in preparation for the examination.

Activity 2

Investigate global warming

Learner's Book page 202

Guidelines to implement this activity

- This is a group activity
- Learners investigate and discuss their research in their groups but write individual reports in their notebooks about their findings.

Suggested answers

- 1.1 Carbon dioxide, ✓methane, ✓carbon monoxide✓ (3)
- 1.2 Carbon dioxide✓ (1)
- 2 Heat radiated from the Earth. ✓ (1)
- 3 Burning fossil fuels ✓ (1)
- 4 Concentrations have fluctuated but the main trend shows an increase. ✓ (1)
- 5 Rise in global temperature increases risk of veld fires and forest fires.
Crops dry up before they can be harvested causing food shortages.
Deserts are increasing, which reduces farmland.
Heat-related illnesses and deaths.
Extremely heavy rain and flooding.
Ice sheets and glaciers are shrinking releasing fresh water into the oceans.
Global sea levels are rising by 2 mm to 3 mm a year. Over 100 million people who live less than 1 m above the present mean sea level are in danger of being flooded.
As animals lose their habitats because of rising sea level or spread of deserts, they will become extinct. ✓ ✓ ✓ ✓ ✓ (Any five) (5)
- 6 Reports should include the above facts.

Total: 12 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 12 and give them feedback on their performance to prepare them for formal assessment.

Remediation/Remedial activity

This can be a difficult assessment for some learners. If they cannot do the activity or do not know how to start, help them to plan by doing a mind map. It is important that they practise the planning and writing of reports.

Extension/Extension activity

If learners have additional information about global warming, for example the hole in the ozone, they may add an extra page under a heading that is appropriate.

Activity 3

Investigate how global warming is affecting the Arctic

Learner's Book page 203

Guidelines to implement this activity

- This is a pair activity.
- Read the case study in class first. Discuss the map with the class.
- Ask learners to study the figures and answer the questions in their notebooks.

Suggested answers

- 1 Canada, ✓USA, ✓Russia, ✓Finland, ✓Sweden, ✓Norway, ✓Denmark and Iceland. ✓ (8)
- 2 Northern hemisphere countries, such as USA, Western Europe and Japan have been burning huge quantities of fossil fuels ✓for much longer than the southern hemisphere countries. The Arctic is close to all of these countries. ✓ (2)
- 3 If Arctic warming continues, ecotourism linked to polar bears will not be sustainable, because the bears are becoming extinct. They have to swim further to find food. Already they are thinner because summer ice is melting. When they become too thin, they become infertile and no babies are born. They will eventually become extinct. ✓ ✓ ✓ ✓ ✓ (Answer and any four reasons) (5)

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.

Remediation/Remedial activity

Revise the answers to the activity on the board and ensure that learners do corrections.

Unit 13 Birth, life and death of stars: The birth of a star

Learner's Book pages 204-205

Unit overview

You will learn how stars form inside huge clouds of gas and dust called nebulae. These nebulae are pulled together by gravity. Eventually it collapses and contracts, releasing enough heat to cause nuclear fusion reactions changing hydrogen to helium. The energy released by these processes makes the star (Sun) 'shine', radiating heat and light energy into space.

Resources

- The beauty of stars being born
www.youtube.com/watch?v=u0gEaDqoH58
- Blue Star Kachina 4th September 2011 12am
www.youtube.com/watch?v=J1XtUeMsWPo

Teaching guidelines

- By simplifying the diagrams, learners will understand them better.
- Ensure that the learners conceptualise all the new terminology.

Background knowledge

The knowledge gained in Grade 8 about planet Earth and beyond formed the basis for learners to understand the concept that gravity holds bodies in space together and in permanent orbit around the Sun. The Sun as the central body/star of the Solar system gave them the basic understanding of stars.

Guidelines to implement this activity

- This is an individual activity that learners will do at home at night time.
- Encourage learners to do the activity with an adult who can explain the night sky.

Assessment guidelines

This activity is for enjoyment only.

Unit 14

Birth and death of stars: Life and death of a star

Learner's Book pages 206-208

Unit overview

Over time, stars change in appearance. Younger stars are hotter and appear blue, whereas stars that are red are usually older. The age of stars is related to their size. Our Sun has a lifetime of about nine billion years. Towards the end of their life, stars swell up to form red giants.

Resources

- Life cycle of a star
www.youtube.com/watch?v=4eILkaeLqZQ
www.youtube.com/watch?v=j-1GNe52Iq8
- Russian news report: NIBIRU exists (It's not Comet Elenin) (red star)
- Life and death of a star
www.youtube.com/watch?v=G1n_tWxDsIA
- Star Life Cycle
www.youtube.com/watch?v=hTLyIi2ctZM

Teaching guidelines

- Explain the changes in appearance of a young star, a middle aged star and a star nearing the end of its life cycle.
- Accentuate the difference between a 'white' and a 'red' giant.
- Use the video clips and the diagrams in the Learner's Book to enhance the learning experience.

Background knowledge

Useful and interesting information about stars is available at:
science.nationalgeographic.com/science/space/universe/stars-article/

Activity 1

Stages of a dying star

Learner's Book page 208

Guidelines to implement this activity

- This is an individual activity.
- Learners redraw the diagram in their notebooks. They have to complete the labels of the diagram.

Background knowledge

Learners should have a solid knowledge base about the different stages in a star's life before this activity is attempted.

Assessment guidelines

This activity is intended for informal assessment.

Remediation/Remedial activity

Learners do corrections in their notebooks under supervision of the educator.

Activity 2

Make a poster about the life cycle of stars

Learner's Book page 208

Guidelines to implement this activity

- This is an individual activity.
- Learners must find material to use. Planning should be done before starting the poster.

TIP!

A good poster attracts people's attention with: Good lay-out; a variety of fonts and images; just enough information that is readable from a distance; not too busy, but containing all the necessary elements.

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 2	Partly 1	No 0
The learner(s):			
followed the instructions in the Learner's Book and understood what to do without help			
learners worked well in the planning and making of the poster			
the poster was neatly done			
good explanatory heading/caption of work			
correct sequencing of the life cycle of a star			
illustrations or pictures support the content of the topic			
short paragraphs were written, explaining all the life stages of a star			
learners completed the task in the allotted time			
poster has sufficient visual impact and is ordered creatively.			
Total: 20 marks			

Remediation/Remedial activity

If learners do not know how to start the poster, help them to organise the subheadings as smaller parts of the poster. Organise the pictures they have found under the subheadings.

Extension/Extension activity

Encourage further discussion on this topic if time permits.

Project (PoA)

Investigate how South Africa contributes to global warming

page 210

Learner's Book

Guidelines to implement this activity

- This is an individual activity.
- Learners have to research emission of greenhouses gases, the biggest contributors to global warming, legislation to control emissions and ways to reduce the amount of gases emitted.

Assessment guidelines

This activity is intended for formal assessment.

Assess according to the table of assessment (marking scheme):

Criteria	Maximum marks allocated
Report is typed or neatly written in learner's own words.	4
Report has a cover page with learner's name and project title.	1
Report has a contents page with headings and page numbers.	1
Report has three to four pages of content excluding the cover, contents and bibliography pages.	1
Report has a bibliography listing at least three references used.	1

[8]

Content:

Criteria	Maximum marks allocated
Clear information on: Greenhouse gases emitted in South Africa.	6
The 'main offenders' in terms of greenhouse gas emission.	8
Legislation to control greenhouse gas emissions.	8
Ways in which South Africa can reduce greenhouse gas emissions.	10 [32]
Relevant illustrations included	10 [10]

Total: 50 marks

Strand 1 Exemplar Test –

Memorandum

- 1.1 B
1.2 D
1.3 A
1.4 E
1.5 C (5)
- 2 Answers should appear in the order: Stem, cell wall, chloroplasts, vacuoles (4)
- 3 Answers should appear in this order: Urine, kidney, bladder (3)
- 4.1 D
4.2 C
4.3 A
4.4 E
4.5 B (5)
- 5 Breathing is the taking in of air into the body ✓ and the release of air from the body. ✓ Gaseous exchange is the movement of gases by diffusion ✓ across cell membranes in the body. ✓ Respiration is the release of energy ✓ from food molecules in body cells, using oxygen. ✓
(6)
- 6 Any three of the following points. The cells need more oxygen, in order to release energy for the muscles. The oxygen is carried in the blood. The heart must beat faster to supply enough oxygenated blood to the muscle cells. (3)
- 7 Answers should appear in this order: oxygen, respiration, diffusion, carbon dioxide, capillaries, excretion (6)
- 8.1 Any four of the following: Fats, proteins, carbohydrates, vitamins, minerals (4)
- 8.2 Roughage. Learners should mention at least one of the following: It adds bulk to food, it gives something for the muscles of the gut to push against, it prevents constipation. (2)
- 9 Large, insoluble molecules are broken up into smaller soluble molecules. Chemical digestion or mechanical digestion. (2)

Total: 40 marks

Strand 2 Exemplar test memorandum

Learner's Book page

1.1	O ₂ ✓	(1)
1.2	CO ₂ ✓	(1)
1.3	H ₂ O ✓	(1)
1.4	Element ✓	(1)
1.5	Compound ✓	(1)
1.6	Compound ✓	(1)
2.1	Magnesium ✓ + Oxygen ✓ → Magnesium oxide ✓	(3)
2.2	Mg ✓ + O ₂ ✓ → MgO ₂ ✓	(3)
2.2	White ✓	(1)
2.4	White ✓	(1)
3.1	Yellow ✓	(1)
3.2	Non-metal ✓	(1)
3.3	16 ✓	(1)
3.4	Blue ✓	(1)
3.5	Sulfur ✓ + oxygen ✓ → sulfur dioxide ✓	(3)
3.6	S ✓ + O ₂ ✓ → SO ₂ ✓	(3)
3.7.1	Sulfuric acid	(2)
3.7.2	Red	(1)
4.1.1	C ✓	(1)
4.1.2	B ✓	(1)
4.1.3	D ✓	(1)
4.1.4	A ✓	(1)
4.1.5	E ✓	(1)
4.2	C ✓	(1)
5.1	A measurement of how acidic ✓ or basic a solution is ✓	(2)
5.2	7 ✓	(1)
5.3.1	Yellow ✓	(1)
5.3.2	Blue ✓	(1)
5.4	Phenolphthalein ✓	(1)
5.5	Universal indicator ✓	(1)

Total: 40 marks

Strand 2 Exemplar mid-year exam memorandum

Learner's Book page 00

Question 1

1.1 B; 1.2 A; 1.3 D; 1.4 B; 1.5 D [5]

Question 2

2.1 microscope

2.2 ingestion

2.3 respiration

2.4 breathing

2.5 gaseous exchange [5]

Question 3

3.1 D; 3.2 C; 3.3 F; 3.4 A; 3.5 B [5]

Question 4

Allocate marks as follows:

Correct and neat drawing (2)

Heading: Diagram of simple plant cell

Labels:

LHS: chloroplast (1), large vacuole (1), cell wall (1)

RHS: cell membrane (1), nucleus (1), cytoplasm (1), mitochondrion (1)

NB. Do not allocate any marks if structures are labelled on the wrong side of the diagram [10]

Question 5

5.1 starch (1)

5.2 iodine solution (1)

5.3 any two: rice, potato, bread, flour, pasta (2)

5.4 fats/oils (1) [5]

Question 6

- 6.1 Testes produce sperm. (1)
- 6.2 Ovaries produce eggs. (1)
- 6.3 Fertilisation takes place in the oviduct. (1)
- 6.4 The embryo is implanted and develops in the uterus. (1)
- 6.5 The placenta provides food and oxygen for the embryo and removes waste products. (1) [5]

Question 7

- 7.1 Exercise makes pulse rate increase. (1)
- 7.2 Number of heartbeats per minute. (1)
- 7.3 Level of physical activity/ exercise. (1)
- 7.4 Group member 3. (1) S/he has the lowest the pulse at rest and after exercise which is an indicator of fitness. (1) [5]

Question 8

- 8.1 A - oxide ✓ (1)
 - 8.2 B - dioxide ✓ (1)
 - 8.3 C - trioxide ✓ (1)
 - 8.4 D - carbonate ✓ (1)
 - 8.5 E - hydroxide ✓ (1)
- [5]

Question 9

- 9.1 Iron oxide ✓ (1)
 - 9.2 Fe_2O_3 ✓ (1)
 - 9.3 Galvanising ✓, electroplating ✓ (learners also describe these ✓✓) (4)
 - 9.4 It is very strong, ✓ can bear strong forces and stretching ✓ (2)
 - 9.5 Steel contains mainly iron ✓ and rust weakens iron. ✓ (2)
- [10]

Question 10

- 10.1 Sulfur dioxide ✓ released into the air from factory smoke reacts with water ✓ to form sulfuric acid. ✓ (3)
- 10.2 It lowers the pH of lakes and rivers. ✓ This often kills fish and other aquatic animals, making the water lifeless. ✓ Acid rain also leaches nutrients from the soil. ✓ Without the nutrients they need, trees and plants die. ✓ Acid rain is particularly damaging to forests. ✓ (Any 2) (2)

- 10.3 CaCO_3 ✓ limestone ✓ (2)
- 10.4 CaO ✓ calcium oxide ✓ (2)
- [9]

Question 11

- 11.1 Hydrochloric acid ✓ + sodium hydroxide ✓ \rightarrow sodium chloride ✓ + water ✓ (4)
- 11.2 HCl ✓ + NaOH ✓ \rightarrow NaCl ✓ + H_2O ✓ (4)
- 11.3 Let the water evaporate ✓ ✓ (2)
- [10]

Question 12

- 12.1 Zinc ✓ + hydrochloric acid ✓ \rightarrow zinc chloride + hydrogen ✓ (4)
- 12.2 Hold a glowing wooden splint ✓ above the tube and listen for a popping noise. ✓ (2)
- [6]

Total: 80 marks

Strand 3 Exemplar test memorandum

Question 1

- 1.1 A ✓ (1)
- 1.2 B ✓ (1)
- 1.3 C ✓ (1)
- 1.4 C ✓ (1)
- 1.5 B ✓ (1)

Question 2

- 1 Force changed the shape of the vehicles – car bodies are mangled ✓ (1)
- 2 Force changed the position of the vehicles – car has overturned ✓ (1)
- 3 Force changed the movement of the vehicles – the vehicles both stopped ✓ (1)
- 4 Force changed the direction of movement of the vehicles – one car is facing the opposite direction ✓ (1)

Question 3

- 3.1 Like poles repel ✓ (1)
- 3.2 Turn one of the magnets around so that the opposite end is facing the other magnet. ✓
- 3.3 The force lines of the magnets will run in the same direction, causing attraction. (1)
- 3.4 Allocate marks as follows:

Heading: Diagram of magnetic fields of two magnets attracted to each other. ✓ ✓
Poles correctly indicated on magnets ✓ ✓
Correct pattern and direction of force lines. ✓ (5)

Question 4

- 4.1 The higher she goes above sea level, the less the force of gravity ✓ (she is further away from the centre of the Earth). Because $F = mg$ ✓ and g gets smaller, her weight (F) decreases ✓ (3)
- 4.2 It stays the same ✓ (1)

Question 5

- 5 $0.1 \text{ kW} \times 12 \text{ h} \times 50 \text{ c/kWh}$ ✓ ✓
 $= 51.2 \text{ cents}$ ✓ (3)

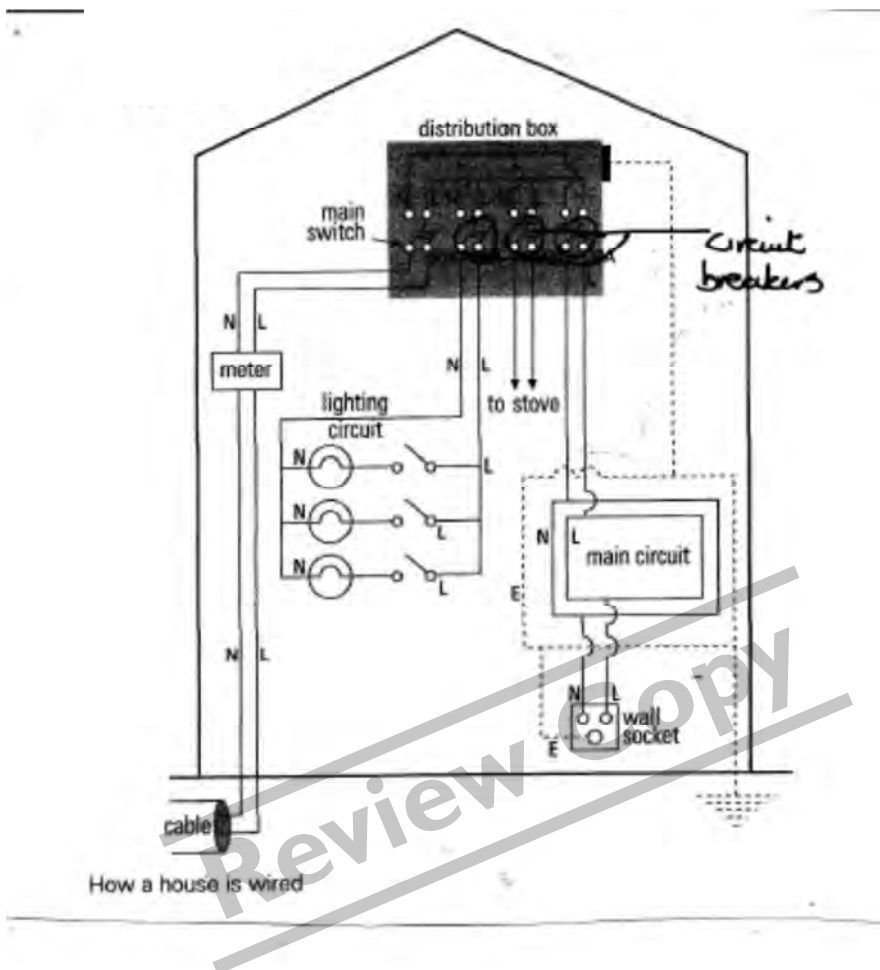
Question 6

- 6.1 False ✓ (1)
- 6.2 True ✓ (1)
- 6.3 True ✓ (1)
- 6.4 False ✓ (1)

Question 7

- 7.1

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- (4)
- 7.2 The bulbs will glow dimmer/ be less bright. ✓The voltage drops when one of the cells is removed ✓because the voltage of cells in series is the sum of the voltage of the individual cells. ✓ (3)
- 7.3 The brightness of the bulbs will be the same. ✓The voltage stays the same for the other two bulbs ✓because voltage of resistors (bulbs) in parallel is the same for each bulb. ✓ (3)
- 7.4 The current will be smaller ✓because the resistance is higher. ✓ (2)

Total: 40 marks

Strand 4 Exemplar test memorandum

Answers

Question 1

1 A-6; B-1; C-5; D-3; E-2; F-4 (6x1)
[6]

Question 2

2.1 Granite, basalt (2x1)
2.2 Quartzite, marble, slate (3x1)
[5]

Question 3

3.1 Iron, nickel (2x1)
3.2 Carbon dioxide, methane, carbon monoxide (Choose TWO) (2x1)
[4]

Question 4

4.1 Limestone is used in the smelting of iron ore to prevent the rocks in the ore from clogging up the furnace. Limestone combines with the rocks in the ore to form slag which floats to the top of the furnace. (2+2)
4.2 It is difficult to breathe at the top of a high mountain because the air is 'thinner' and contains far less oxygen. (2)
[6]

Question 5

5.1 Re-arrange these layers in order from the centre of the Earth:
Inner core, outer core, mantle, crust. (4x1)
5.2 Re-arrange these events in the order they would occur in the rock cycle:
Igneous rocks form, weathering and erosion, sedimentary rocks form and lastly metamorphic rocks form. (4x1)
[8]

Question 6

6.1 Temperature gradients. (2)
6.2 BC shows temperature decreasing with altitude. (1)
6.3 Stratosphere or thermosphere. (1)
6.4 Troposphere or mesosphere. (1)
[5]

Question 7

- 7 Stop using fossil fuels which put carbon dioxide into the air. (2)
Use more environmentally friendly ways of generating electricity, such as solar and wind. (2)
Reduce the number of cattle which are emitting methane into the atmosphere. (2)
[6]
[40]

Total: 40 marks

Strand 4 Exemplar end-of-year exam memorandum

Question 1

- 1.1 Magnetic✓ (1)
1.2 Electrons✓ (1)
1.3 Rheostat✓ (1)
1.4 National grid✓ (1)
[4]

Question 2

- 2.1 A✓ (2)
2.2 C✓ (2)
2.3 C✓ (2)
2.4 D✓ (2)
2.5 C✓ (2)
2.6 C✓ (2)
2.7 B✓ (2)
2.8 A✓ (2)
2.9 B✓ (2)

[9x2 = 18]

Question 3

- 3.1 No✓ – she experiences a change in position✓ (2)
3.2 Compressional contact force✓ ✓ (2)
3.3 Gravity✓, a field force✓ (2)
3.4 The Earth (1)
3.5 Moving higher above sea level means smaller✓ gravitational force, so smaller weight. ✓ She is now further from the centre of the Earth✓ (3)

- 3.6 It stayed the same. ✓ (1)
[11]

Question 4

- 4.1 A meteor is a piece of rock travelling in space and a meteorite is a meteor that has entered the Earth's atmosphere. (2)
4.2 A star is the general name for a cloud of burning gas in space that gives off light and heat. ✓ When a star reaches old age its core collapses into an almost dead star, called a white dwarf. ✓ When big stars die they blow up with a huge explosion, called a supernova. ✓ (3)

Question 5

- 5.1 $R = V/I = 3/6 = 0,5 \Omega$ ✓✓ (4)
5.2 Stay 3 V ✓ (1)
5.3 Double to 12 V ✓ (1)
[6]

Question 6

- 6.1 There are no clouds in the stratosphere because there is no water vapour ✓ and therefore no condensation can take place. ✓ (2)
6.2 In cold air the gas molecules move closer together and there is less space for water vapour. ✓ In warm air the gas molecules move far apart and there is more space for water vapour. ✓ Illustrate your answer with diagrams ✓ (3)
6.3.1 The copper oxide will be reduced ✓ to copper ✓ and carbon dioxide ✓ gas will be given off. ✓ (4)
6.3.2 $\text{CuO(s)} + \text{C(s)} \rightarrow 2\text{Cu(s)} + \text{CO}_2\text{(g)}$. ✓ (2)
Copper oxide + carbon ✓ → copper + carbon dioxide ✓ (2)
6.4 An oxygen molecule consists of two oxygen atoms bonded together ✓ and an ozone molecule consists of three oxygen atoms bonded together. ✓ (2)
[17]

Question 7

- 7.1 $1 \text{ kWh} = 1000 \text{ Wh} = 1000 \times 3600 \text{ Js} = 3\,600\,000 \text{ J}$ ✓ (3)
7.2 # of kWh = power rating x # of hours = $0,014 \times 8 = 0,112 \text{ kWh}$
cost = # of kWh x cost per kWh = $0,112 \times 50 = 5,6 \text{ c}$ ✓ (5)
7.3 Less energy needed, ✓ fewer power stations have to be built, ✓ and less likely to have power outages/can ensure uninterrupted energy supply ✓ (3)
[11]

Question 8

8.1 An environmental impact study is a study that takes place before mining or construction starts, ✓ to assess the possible negative impacts on the environment. ✓

(2)

8.2 Shaft mining ✓

(1)

8.3 Wildlife would leave the area, ✓ noise, ✓ air pollution, ✓ roads and heavy truck traffic through the reserve, ✓ tourists would stop visiting. ✓

(5)

Total: 80 marks

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