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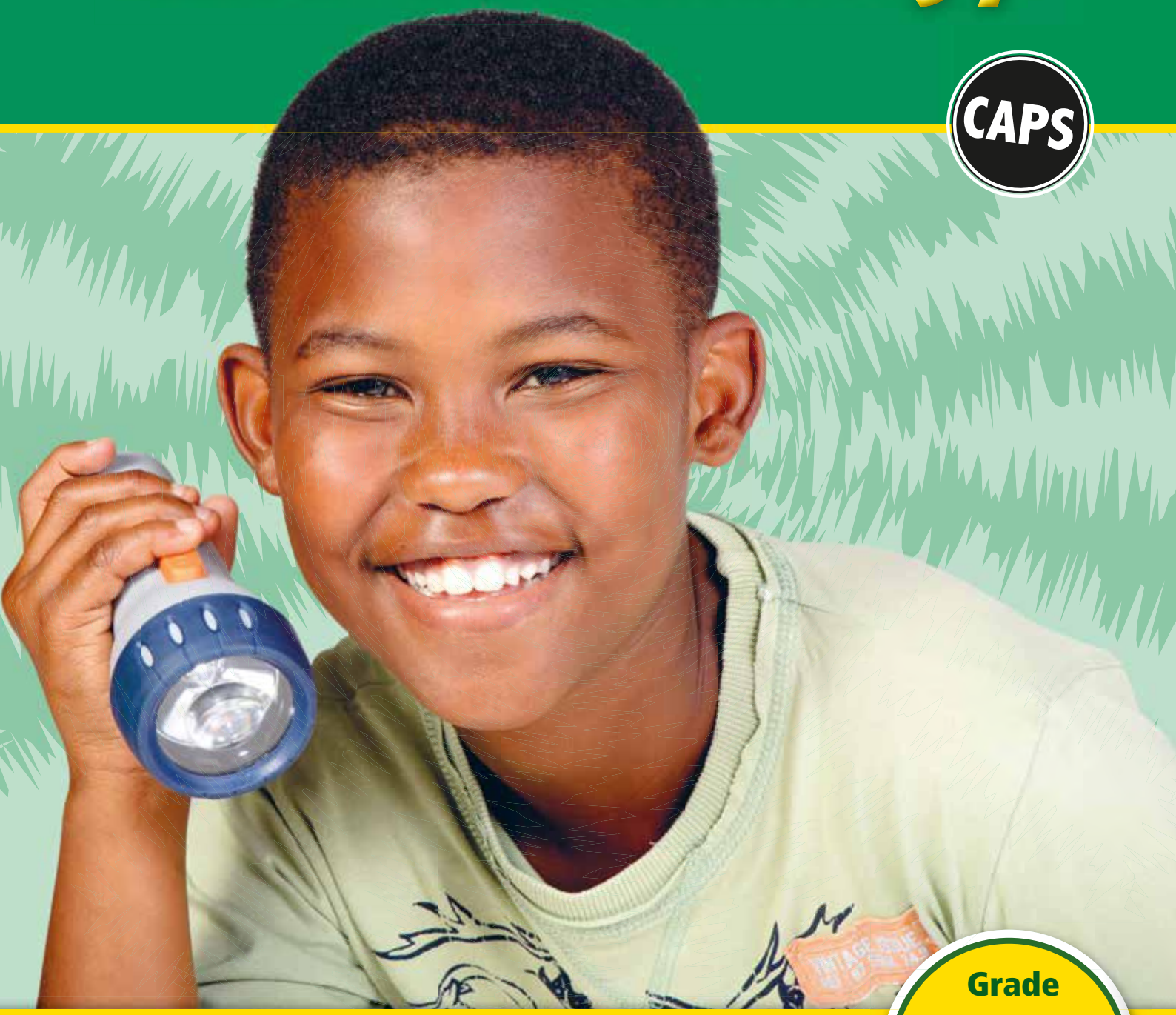
Natural Sciences and Technology

CAPS



Grade 6

Teacher's Guide

David Green • Ria de Jager • Linda Bredenkamp
Marietjie van den Heever

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Term	**Strand**	**Topic**	**Unit**	**Natural Sciences and Technology CAPS content**	**Time allocation**	**Resources**	**LB page**	**TG page**
1	Natural Sciences: Life and living Technology: Processing	1: Photosynthesis	1.1: Plants and food	• Plants make their own food (glucose sugar) through a process called photosynthesis • Photosynthesis takes place mainly in the leaves • During photosynthesis the plant uses sunlight energy, carbon dioxide (from the air) and water to make glucose sugar • Plants change some of the glucose sugar into starch which they store in their leaves, stems and roots, flowers, fruits and seeds	$2\frac{1}{2}$ weeks ($8\frac{3}{4}$ hours)	Glucose powder, maize flour, iodine solution, plastic droppers, examples of food such as cooked rice, flour, potato, bread, oil, boiled egg, cheese; video clips from the Internet	10	B4
			1.2: Plants and air	• During photosynthesis the plant uses carbon dioxide from the air and gives off oxygen into the air • Animals, including people, use the oxygen from the air for breathing and give out carbon dioxide which is used by plants for photosynthesis		Small plants, candles, matches, bell jars, rubber stoppers, Vaseline, clear lime water, beakers or transparent containers, straws	13	B6
		2: Nutrients in food	2.1: Food groups	• Foods can be grouped according to their functions in the body and the main nutrients they supply: – foods for energy – carbohydrates – foods for growth and repair – proteins – foods for storing energy (in the form of body fats) and providing insulation and protection for nerves and organs – fats and oils – foods for building bones and teeth, and maintaining a healthy immune system – vitamins and minerals • Most natural foods contain a mixture of more than one nutrient group • Most processed (manufactured) foods have added salt, sugar, preservatives, flavourings and colourings	$1\frac{1}{2}$ weeks ($5\frac{1}{4}$ hours)	Drawings of different food types and food packaging, different foods, iodine solution, potatoes, white bread, eggs (separated), surgical gloves	15	B8
		3: Nutrition	3.1: Balanced diets	• A diet refers to the selection of foods we eat every day • A balanced diet contains sufficient quantities of food from all four nutrient groups, as well as water and fibre • Some diseases can be related to diet	$1\frac{1}{2}$ weeks ($5\frac{1}{4}$ hours)	Pamphlets, charts and posters, lists of different diets, drawings and information about food-related illnesses	23	B11

Term	Strand	Topic	Unit	Natural Sciences and Technology CAPS content	Time allocation	Resources	LB page	TG page
1		4: Food processing	4.1: Need for processing food	• Food is processed to: – make it edible (preparing, cooking) – make it last longer (preserving) – improve its nutrient value (fermenting) • During processing many foods may lose some of their nutrients	$2\frac{1}{2}$ weeks ($8\frac{3}{4}$ hours)	Drawings and information about how food is processed, foods for processing	30	B14
			4.2: Methods for processing food	• There are many different methods (ways) to process food			35	B17
		5: Ecosystems and food webs	5.1: Different ecosystems	• An ecosystem is an area where living and non-living things depend on each other in many different ways • There are many different ecosystems such as rivers, mountains, sea, rocky shores, ponds, wetlands, grasslands, forests and deserts, which support different kinds of living things	2 weeks (7 hours)	Drawings of ecosystems such as rivers, mountain, seas, rocky shores, ponds, wetlands, grasslands, forests and deserts	40	B18
			5.2: Living and non-living things in eco-systems	• In an ecosystem there are certain relationships between living things (plants, animals/people, microorganisms) and non-living things (air, water, sunlight, soil) in a particular area*			48	B19
			5.3: Food webs	• In an ecosystem plants and animals are connected by their feeding relationships; this is called a food web • A food web consists of: – plants (producers) which produce food for themselves and animals – animals (consumers) which are herbivores, carnivores or omnivores – microorganisms (decomposers) that break down dead plant and animal matter and return nutrients to the soil			50	B20
		Notes: * Healthy ecosystems depend on sufficient biodiversity of plants, animals and their habitats.						
		Assessment		Revision: Test			56	B22
				Selected Practical Task			37	B17
							55	B21
					Total: 10 weeks (35 hours)			

Term	Strand	Topic	Unit	Natural Sciences and Technology CAPS content	Time allocation	Resources	LB page	TG page
2	Natural Sciences: Matter and materials Technology: Processing	1: Solids, liquids and gases	1.1: Arrangement of particles	• All matter (solids, liquids and gases) is made up of particles • The particles are arranged differently in solids, liquids and gases: – in solids the particles are closely packed in a regular pattern – spaces between the particles are small and particles vibrate in one place – in liquids the particles are closely packed in no fixed pattern – spaces between the particles are small but particles can move around each other – in gases the particles are far apart from each other – spaces between the particles are big and particles move in all directions	$\frac{1}{2}$ week ($1\frac{3}{4}$ hours)	Diagrams to show particles in matter, video clips from the Internet	59	B24
		2: Mixtures	2.1: Mixtures of materials	• A mixture consists of at least two different substances/ materials mixed together • In some mixtures, the different substances are still clearly visible after mixing: – the substances in such mixtures can be separated by physical means such as sieving, filtering, hand sorting, settling and decanting	1 week ($3\frac{1}{2}$ hours)	Examples of materials such as salt, sand, sugar, tea leaves, peanuts, dried beans, coins, sweets, curry powder, grated cheese, milk, oil; video clips from the Internet	62	B26
		3: Solutions as special mixtures	3.1: Solutions	• Solutions are also mixtures • Some solutions can be made by mixing a solid and a liquid together such as sugar and water, or salt and water • Solutions are uniform in appearance and the solid cannot be seen after mixing	$2\frac{1}{2}$ weeks ($8\frac{3}{4}$ hours)	Basic science apparatus and materials for the various experiments in this topic, e.g. glass beakers, hot plate or Bunsen burner, turpentine, measuring cylinders, funnels, filter paper, evaporative dish, food colouring; examples of materials and substances such as salt, sugar, sand, mealie meal, flour, maize flour, samp, curry powder, custard powder	65	B27

Term	Strand	Topic	Unit	Natural Sciences and Technology CAPS content	Time allocation	Resources	LB page	TG page
2			3.2: Soluble substances	• Soluble solids (solutes) can dissolve* in water (solvent) • The substances in solutions cannot be separated by sieving, filtering, hand sorting, settling or decanting • Some solutes can be recovered (separated) by evaporating the solvent (such as recovering salt from sea water) • When substances dissolve, solute particles become dispersed in the spaces between the solvent particles		Basic science apparatus and materials for the various experiments in this topic, e.g. glass beakers, hot plate or Bunsen burner, turpentine (refer to the various activities for what you need)	67	B29
			3.3: Saturated solutions	• A solution is saturated when no more solute can dissolve in a given amount of solvent		Glass beakers, hot water, sugar	71	B30
			3.4: Insoluble substances	• Some solids will not form a solution in water (insoluble solids)		Basic science apparatus and materials for the various experiments in this topic; bottom halves of plastic 2lbottles, glass beakers, soil, oil paint, turpentine, candles, methylated spirits; if possible, water-based craft paint can be dissolved in water as a comparative test	72	B30
		4: Dissolving	4.1: Rates of dissolving	• Factors that affect the rate (time taken) of dissolving: – temperature of the mixture – stirring or shaking the mixture – grain size of the solute	1 week ($3\frac{1}{2}$ hours)	Containers, beakers, ice-cream sticks for stirring, measuring spoons, hot water, salt (coarse and fine)	75	B31

Term	Strand	Topic	Unit	Natural Sciences and Technology CAPS content	Time allocation	Resources	LB page	TG page
2		5: Mixtures and water resources	5.1: Water pollution	• In the environment, many things mix or dissolve in water • Water can be polluted by – insoluble substances such as oil, plastics, tyres, tins, glass and toilet waste – soluble substances such as soaps, fertilizers, insecticides, acids and other poisons – living germs from toilet waste causing water-borne illnesses such as diarrhoea	$2\frac{1}{2}$ weeks ($8\frac{3}{4}$ hours)	Texts for reading about water pollution, video clips from the Internet	81	B34
			5.2: Importance of wetlands	• Natural wetlands are important for – removing soluble and insoluble substances from water – acting like sponges and regulating the flow of water		Information about wetlands in your own area; if possible, try to take your class on an excursion to a nearby wetland	83	B35
		6: Processes to purify water	6.1: Clean water	• A clean supply of water is important for people, plants and animals • Water can be cleaned by processes such as sieving, filtering, settling, decanting, boiling and adding chemicals to kill germs	$2\frac{1}{2}$ weeks ($8\frac{3}{4}$ hours)	Sieves, filter paper, funnels, containers, kettles, water purification tablets (if possible)	88	B37
		Notes: * A common misconception is that sugar or salt "melts" away when added to water. Dissolving (in the case of sugar and salt in water) requires two materials to be mixed together. This is different from melting (in the case of ice) which is a result of heating one material to change its state.						
		Assessment		Revision: Test			94	B39
				Selected Practical Task			65	B28
							78	B32
					Total: 10 weeks (35 hours)			

Term	Strand	Topic	Unit	Natural Sciences and Technology CAPS content	Time allocation	Resources	LB page	TG page
3	Natural Sciences: Energy and change Technology: Systems and control	1: Electric circuits	1.1: A simple circuit	• An electric circuit is a system for transferring energy • A simple circuit always has the following components: – source of energy (such as a cell/battery) – conducting material (such as wires) – device (such as a light bulb, buzzers or motors) for changing electricity into useful output energy • a circuit is a complete, unbroken pathway for electricity • a switch can be added to break or complete the circuit pathway	$2\frac{1}{2}$ weeks ($8\frac{3}{4}$ hours)	Cells, bulbs, insulated wires, switches, diagrams	97	B42
			1.2: Circuit diagrams	• symbols are used when drawing circuit diagrams			102	B44
		2: Electrical conductors and insulators	2.1: Conductors	• some materials conduct electricity and are called conductors – most metals, especially copper, conduct electricity	2 weeks (7 hours)	Cells, bulbs, insulated wires, switches; coins, paper clips, pieces of wire, metal utensils, etc.	104	B46
			2.2: Insulators	• some materials do not conduct electricity and are called insulators • most non-metals, especially plastic, do not conduct electricity		Cells, bulbs, insulated wires, switches; plastic, cardboard, wood, rubber objects, ceramic, etc.	106	B47
		3: Systems to solve problems	3.1: Using electric circuits	• electric circuits are often used to solve problems that require energy, such as street lighting, alarms, electric gates, traffic lights, fans and heaters • electric circuits can also be used in models and toys	$2\frac{1}{2}$ weeks ($8\frac{3}{4}$ hours)	Drawings, posters, real examples of circuits; cells, bulbs, insulated wires, switches, buzzer bells	109	B49
		4: Mains electricity	4.1: Fossil fuels and electricity	• Fossil fuels were formed in the Earth's crust millions of years ago from dead plants and animals • Coal, oil and natural gas are fossil fuels • In South Africa coal is mostly used as a fuel in power stations and to make synthetic petrol, diesel etc SASOL • Coal was formed from fossilised plants which got their energy from the Sun originally • In a power station coal is used to boil water, the steam turns a turbine which turns a generator, which produces electricity • Fossil fuels are non-renewable resources	3 weeks ($10\frac{1}{2}$ hours)	Drawings and video clips of fuels and their various uses; drawings to show how electricity is generated in a coal-fired power station; examples of electrical appliances	116	B53

Term	Strand	Topic	Unit	Natural Sciences and Technology CAPS content	Time allocation	Resources	LB page	TG page
3			4.2: Cost of electricity	• Electricity is costly because: – it requires infrastructure including coal mines, transport, power stations, pylons, substations, wiring – some electrical appliances require more electricity than others (heating appliances use the most) • The more electricity we use the more we pay, and the more coal is used up • We can save energy in many ways, including using energy-saving light bulbs and solar water heaters			122	B55
			4.3: Illegal connections	• Illegal electrical connections are a danger to people because they are often unsafe		Drawings of safety signs	126	B56
			4.4: Renewable ways to generate electricity	• People are looking for renewable ways to generate electricity		Drawings of renewable ways to generate electricity, including examples of wind power generator, solar power generator, hydroelectric generators	128	B56
		Assessment		Revision: Test			133	B57
				Selected Practical Task			105	B47
							112	B50
					Total: 10 weeks (35 hours)			

Term	Strand	Topic	Unit	Natural Sciences and Technology CAPS content	Time allocation	Resources	LB page	TG page
4	Natural Sciences: Planet Earth and beyond Technology: Systems and control	1: The solar system	1.1: The Sun, planets and asteroids	• The Sun (a star) is at the centre of our Solar System • There are eight planets and the asteroid belt (Mercury, Venus, Earth, Mars, Asteroid Belt, Jupiter, Saturn, Uranus and Neptune) in orbit around the Sun • Each planet has its own: – features, size, orbit and position in relation to the Sun, composition (rocky and gas planets) and number of Moons (some have no Moons) • The planets and asteroids take different amounts of time to revolve around the Sun*	$2\frac{1}{2}$ weeks ($8\frac{3}{4}$ hours)	Detailed drawings and models of the solar system, any extra information about the solar system	136 – 139	B60 – B62
			1.2: Moons	• Moons, including our Moon, do not give out their own heat and light • Our Moon can be seen from Earth because the light from the Sun shines onto its surface • On the Moon we can see craters, lighter areas which are mountains, and darker areas which are flat plains		Drawings of the Moon	146	B62
		2: Movements of the Earth and planets	2.1: Rotation (Earth)	• In our solar system, each planet rotates (spins) on its own axis: – the planet Earth is spinning, and one complete rotation takes about 24 hours and we experience this as day and night – during rotation the side of the Earth facing the Sun experiences daytime, and the opposite side of the Earth experiences night time	1 week ($3\frac{1}{2}$ hours)	Models and a light source such as a torch, lamp or candle to demonstrate the movement of the Earth	149	B63
			2.2: Revolution (Earth)	• All planets also revolve (travel) around the Sun in their own orbits • Planet Earth revolves around the Sun in its own orbit (pathway); one complete revolution takes $365\frac{1}{4}$ days and we experience this as a year			151	B64
		3: The movement of the Moon	3.1: Rotation (of the Moon)	• The Moon is spinning and one complete rotation takes about 28 days	1 week ($3\frac{1}{2}$ hours)	Models and a light source such as a torch, lamp or candle to demonstrate the movement of the Moon	156	B66
			3.2: Revolution (of the Moon)	• The Moon revolves around the Earth and one revolution also takes about a month (about 28 days)			157	B66
		4: Systems for looking into space	4.1: Telescopes	• Telescopes are used to look into space and gather information • South Africa has built and uses some of the largest telescopes	1 week ($3\frac{1}{2}$ hours)	Drawings and information about telescopes	160	B68

Term	Strand	Topic	Unit	Natural Sciences and Technology CAPS content	Time allocation	Resources	LB page	TG page
4		5: Systems to explore the Moon and Mars	5.1: Vehicles used on the Moon	• A few people have visited the surface of the Moon and explored it using a vehicle called a Moon Rover	$2\frac{1}{2}$ weeks ($8\frac{3}{4}$ hours)	Drawings of the Moon and Mars rovers; apparatus including bottle tops or lids, round tins or cardboard circles for the wheels, sosatie sticks or dowels and straws for the axles	163	B69
			5.2: Vehicles used on Mars	• Robots called Mars Rovers have been used to visit and explore the surface of Mars (people have not yet visited Mars)			173	B70
		Notes: * It is not necessary to memorise exact numbers of size of planets, number of Moons, and distance from the Sun.						
		Assessment		Revision: Test			176	B70
				Selected Practical Task			159	B67
					Total: 8 weeks (28 hours)			
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Section D: Documents								**D1**

Section A: Introduction

Curriculum and Assessment Policy Statement (CAPS)

The National Curriculum Statement Grades R–12 (NCS), which stipulates policy on curriculum and assessment in the schooling sector was amended, with the amendments coming into effect in January 2012. A single comprehensive **National Curriculum and Assessment Policy Statement** (CAPS) was developed for each subject to replace the old Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R–12. The CAPS for each subject details the minimum outcomes and standards of the learning process as well as assessment processes and procedures.

General aims of the South African Curriculum

The National Curriculum Statement Grades R–12 gives expression to what are regarded to be knowledge, skills and values worth learning. It will ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. In this regard, the curriculum promotes the idea of grounding knowledge in local contexts, while being sensitive to global imperatives.

The purpose of the National Curriculum Statement Grades R–12

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

The principles of the National Curriculum Statement Grades R–12

- **Social transformation**
  The Constitution of the Republic of South Africa forms the basis for social transformation in our post-apartheid society. Social transformation in education is aimed at ensuring that the educational imbalances of the past are redressed, and that equal educational opportunities are provided for all sections of our population.

  What does this mean in your classroom? Your learners will come from families and communities that have been affected in diverse ways by South Africa's past. They will have many different ideas about what kind of future they want, and what kind of society they want to live in. In the learning program that you plan for the year, you need to provide opportunities for the learners to explore

and come to understand the kind of society we all want to create in South Africa and offer them possibilities for their future.

- **Active and critical learning**
  The National Curriculum Statement encourages an active and critical approach to learning, rather than rote and uncritical learning of given truths.
  What does this mean in your classroom? You should use a variety of activities that encourage the learners to engage with the content and with their fellow learners and explore the world around them.
- **High knowledge and high skills in learners**
  It specifies the minimum standards of knowledge and skills at each grade and sets high, achievable standards in all subjects.
  What does this mean in your classroom? You as the teacher should inspire your learners with relevant knowledge and activities that will encourage them to want to explore the world around them and relate what they learn to their lives outside school. Strive to develop a high level of knowledge and skills in all your learners.
- **Progression**
  Progression refers to the process of developing more advanced and complex knowledge and skills. The content and context of each grade show progression from simple to complex.
  What does this mean in your classroom? If you plan a learning programme using this course, you will ensure that your learners are progressing appropriately through the levels of knowledge and skills that the curriculum requires.
- **Human rights, inclusivity, environmental and social justice**
  The National Curriculum Statement is infused with the principles and practices of social and environmental justice and human rights as defined by the Constitution of the Republic of South Africa. In particular, they are sensitive to issues of diversity, such as poverty, inequality, race, gender, language, age and disability.
  What does this mean in your classroom? In all activities that you organise and facilitate you should create opportunities to relate your subject to the broader social goal of promoting human rights, environmental justice and social justice. Take into account that some of your learners might be grappling with issues, such as poverty, language, disability, etc. in their daily lives, and encourage them to explore these issues in ways that relate to this subject.
- **Valuing indigenous knowledge systems**
  Indigenous knowledge systems in the South African context refer to a body of knowledge embedded in African philosophical thinking and social practices that have evolved over thousands of years. The National Curriculum Statement acknowledges the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution.
  What does this mean in your classroom? Draw on the expertise in your subject that may be available in your local community. Find out about individuals and organisations in your region that

can support your classroom work by means of relevant indigenous knowledge to which they have access. Encourage learners to tap into sources of relevant indigenous knowledge in their own communities. For example: People from indigenous cultures have always found ways to collect and preserve uncontaminated water. By finding out about such water collection practices, we can learn how to minimise contamination of water resources.

- **Credibility, quality and efficiency**
  The National Curriculum Statement aims to achieve credibility through providing an education that is comparable in quality, breadth and depth to the curricula of other countries. We live in a world community in which knowledge and people are circulated all the time. It is important that other countries in the world recognise the qualifications acquired in the South African school system and that these standards are set from the ground up.

Qualities and skills of learners

The National Curriculum Statement aims to produce learners that are able to:

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

Inclusivity

Inclusivity should form part of your planning, so be aware of the barriers to learning in your class and plan accordingly.

As teachers we must always remember that every learner has the right to learn no matter what their learning barriers are. Inclusion means that all the learners should belong. Each learner is unique and the teacher must learn to build on the individual strengths of each learner. It is important that the other learners in the class be informed about a learner's barriers as this may make them more compassionate, tolerant and accepting.

When children are included and involved in the subject it will often improve their attention span, persistence and commitment to the subject. It is important that all learners have a sense of achievement no matter what the challenges are. This will improve their self-esteem.

When a learner is struggling with some activity, allocate a 'buddy' who can help them. Make sure the tasks that are given to the learners with barriers are more focused and shorter. If the class is doing movement, the learner with a physical barrier can sit in a chair and move their arms and the buddy learner can move around them.

It is also the teacher's job to encourage the learners with barriers to ask for help either from their 'buddy' or the teacher.

> 'It is easier for us (teachers) to change the way in which we teach than for them (the learner) to change the way in which they learn' – Chasty 1985.

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

Inclusive education and training should:

- acknowledge that all children and youth can learn and that all children and youth need support
- accept and respect the fact that all learners are different and have different learning needs, which are equally valued
- enable education structures, systems and learning methodologies to meet the needs of the learner
- acknowledge and respect differences in children, whether due to age, gender, ethnicity, language, class, disability, HIV status, etc.
- maximise the participation of all learners in the culture and the curriculum of educational institutions and uncover and minimise barriers to learning.

What does this mean in your classroom? In this series of books the learners work together in groups and pairs, which gives them the opportunity to learn from each other, as well as at their own pace. The learning methodologies also cater for learners with different learning abilities. A wide range of activities is included in this series. This allows you to decide, based on your particular situation and the skills levels of your learners, which activities should be done by which learners. Some of the activities could be used as extension work for more advanced learners, while others can be used as remedial work for learners requiring additional support. Gender is also addressed as both boys and girls are able to participate in all the activities. Learners also have the opportunity to learn about diversity within the subject matter covered.

Learners with physical barriers can work in groups or with a partner so they can be assisted where necessary. The teacher must therefore group learners with disabilities together with learners with other disabilities or no disabilities so they can support each other.

Special needs

In many classrooms, learners with special needs require additional attention – in some cases very little, and in others more extensively. Teachers should be especially sensitive towards these learners without

drawing too much attention to the learner's possible barrier to learning, and somehow making fellow learners aware of the need to treat each other with respect without exception. This vital life skill should be engrained in all young people so that it becomes part of their personalities for the rest of their lives. The information that follows will assist you in addressing some of these special needs in your classroom in an inclusive way. Be aware of these and other special needs of learners in your classroom.

Partial sight or blindness: For partially-sighted learners who find it difficult to read text, text could be enlarged by using a photocopy machine. Also, ensure that these learners sit in the middle at the front of the class so that their poor eyesight does not become a barrier to their learning.

Alternatively – especially in group work – text could be read aloud to these learners. Remember to read loudly, clearly and slowly as partially sighted and blind learners rely heavily on their memories.

Hard of hearing: Once again, these learners should sit in the front of the class. Remember to face the learner directly and speak loudly and clearly, but without exaggerating when giving instructions, or when reading text to these learners. Learners who are hard of hearing learn very early in life to lip-read.

Impaired social skills: The nature of these difficulties varies, but could, in some cases, become a serious barrier to learning.

- Learners who are very shy or highly-strung might find speaking in front of the class extremely stressful. Although they should be encouraged to develop this life skill, it should be remembered that one can never change someone's nature completely. Work gently with these learners – their shyness or nervousness may even be the result of negative circumstances at home. Let them do their 'class presentations' in written form at first, and then move slowly as the year progresses, at first letting them speak to one classmate only, then to a small group, and finally to the whole class.
- Children with ADS (Attention Deficit Syndrome, also known as ADD – Attention Deficit Disorder) will find it extremely difficult to work in groups or to sit still and concentrate for very long – in some cases simply having to listen for two minutes is too long. Learners with ADS could affect the class atmosphere and class discipline in a negative way, and although everyone will agree that the deficiency is no fault of their own, they should not be allowed to ruin their fellow learners' education.

  The school should have a policy that parents must inform the school confidentially if their child suffers from ADS. If learners have been diagnosed, they could be on medication. It is essential that teachers are informed, otherwise the learner could simply be branded as 'extremely naughty', which would be unfair and result in inappropriate handling. Teachers should be very careful not to judge a 'naughty' learner too soon. ADS is becoming quite common, and in some cases may not have been diagnosed at all.

Be on the look-out for a learner who:

- finds it hard or even impossible to concentrate
- frequently interrupts the teacher with irrelevant or seemingly 'stupid' questions
- fidgets all the time to the point of irritating peers
- jumps up frequently and asks to go to the bathroom (or somewhere else) at inappropriate times
- shouts out answers or remarks when the class has been asked to put up their hands
- is unable to deal with group work or pair sessions – these periods are 'interpreted' as a 'free for all'
- shows signs of aggression when fairly disciplined
- argues with the teacher when asked to keep quiet.

Please note that:

- the disorder is more prolific among boys than among girls
- diet could play a role in controlling the disorder – fast foods and junk foods should be kept to a minimum
- not all 'naughty' children have ADS.

Extreme poverty: This barrier to learning requires extreme sensitivity from the teacher. If you know that there are one or more learners in your class who come from poverty-stricken backgrounds, you could handle the situation as follows:

- Learners are often required to bring resources from home, especially for practical activities in subjects like visual arts, technology and science. Some learners may be unable to afford additional resource materials: magazines for research and making posters; cereal boxes; colour pencils or Kokis; paper plates; their own scissors; plastic straws; rulers; calculators. Keep a supply of these items in your classroom without informing your learners and unobtrusively give them to those learners whom you know have difficulty in acquiring them. Be careful not to encourage 'forgetters' to make use of this offer! You could ask community groups and businesses in your area to provide support in collecting supplies of materials for you to keep in your classroom.

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

Time allocation per subject

The instructional time in the Intermediate Phase is as follows:

Subject	Time allocation per week (hours)
Home language	6
First additional language	5
Mathematics	6
Natural Science and Technology	$3\frac{1}{2}$
Social Sciences	3
Life Skills • Creative Arts • Physical Education • Personal and Social Well-being	4 ($1\frac{1}{2}$) (1) ($1\frac{1}{2}$)
TOTAL	**$27\frac{1}{2}$**

The allocated time per week may be utilised only for the minimum required NCS subjects as specified above, and may not be used for any additional subjects added to the list of minimum subjects.

Natural Sciences and Technology in the school curriculum

Aims

Science and Technology is an integrated subject that is compulsory for all learners in the Intermediate Phase. This is so because the subject is critical for promoting and developing scientific and technological literacy in preparation for the compulsory, but separate subjects Natural Sciences and Technology in the Senior Phase (Grades 7 to 9).

This integrated subject aims to build learners' investigative skills by honing their discovery skills with practical investigations and developing their research skills by encouraging them to use reference books and other media. In the course of analysing the results of practical experiments, learners get to practise their observation skills and critical thinking and learn to draw conclusions from a set of results. Learners will also learn how to represent experimental apparatus and design ideas by drawing simple diagrams showing a single viewpoint in two dimensions. Through the application of the design process in Technology they will also begin to evaluate designs in terms of fitness-for-purpose, aesthetic appearance and possible impact on society and the environment.

Purpose

The Curriculum and Assessment Policy Statement (CAPS) for Natural Sciences and Technology identifies the following as the three main purposes of the subject:

- Development of scientific and technological knowledge and understanding
- Development of science process skills (scientific investigations) and technological skills (the design process)
- Development of an understanding of the relevance of Science and Technology in society.

Refer to your copy of the CAPS for Natural Sciences and Technology (page 8) for further explanation of the above.

The main Science process skills and technological and design skills

The development of the skills referred to on page A9 and listed below are essential for the teaching and learning of Natural Sciences and Technology.

1. Accessing and recalling information – being able to use a variety of sources to acquire information, and to remember relevant facts and key ideas, and to build a conceptual framework
2. Observing – noting in detail objects, organisms and events
3. Comparing – noting similarities and differences between things
4. Measuring – using measuring instruments such as rulers, thermometers, clocks and syringes (for volume)
5. Sorting and classifying – applying criteria in order to sort items into a table, mind-map, key, list or other format
6. Identifying problems and issues – being able to articulate the needs and wants of people in society
7. Raising questions – being able to think of, and articulate relevant questions about problems, issues, and natural phenomena
8. Predicting – stating, before an investigation, what you think the results will be for that particular investigation
9. Hypothesising – putting forward a suggestion or possible explanation to account for certain facts. A hypothesis is used as a basis for further investigation, which will prove or disprove the hypothesis
10. Planning investigations – thinking through the method for an activity or investigation in advance. Identifying the need to make an investigation a fair test by keeping some things (variables) the same whilst others vary
11. Doing investigations – this involves carrying out methods using appropriate apparatus and equipment, and collecting data by observing and comparing, measuring and estimating, sequencing, or sorting and classifying. Sometimes an investigation has to be repeated to verify the results.
12. Recording information – recording data from an investigation in a systematic way, including drawings, descriptions, tables and graphs
13. Interpreting information – explaining what the results of an activity or investigation mean (this includes reading skills)
14. Designing – showing (e.g. by drawing) how something is to be made taking into account the design brief, specifications and constraints
15. Making/constructing – building or assembling an object using appropriate materials and tools and using skills such as measuring, cutting, folding, rolling, gluing
16. Evaluating and Improving products – using criteria to assess a constructed object and then stating or carrying out ways to refine that object
17. Communicating – using written, oral, visual, graphic and other forms of communication to make information available to other people

Specific Aims

Three broad subject-specific aims have been identified for Natural Sciences and Technology. These are tabulated overleaf for your information.

Specific Aim	Cognitive skill	Requirements for development of skill	Assessment of skill
Specific Aim 1: **Doing science and technology** Learners should be able to complete investigations, analyse problems and use practical processes and skills in designing and evaluating solutions.	**Note:** Doing practical investigations and designing and making solutions involves a specific range of skills, which are indicated in the next column. The knowledge and understanding of doing science and technology should be assessed within the context of the cognitive domains of Specific Aim 2.	• Follow instructions • Handle equipment, apparatus and tools • Make observations • Record information or data • Measure • Interpret • Design/plan investigations, experiments or solutions to everyday problems	
Specific Aim 2: **Understanding and connecting ideas** Learners should have a grasp of scientific, technological and environmental knowledge and be able to apply it in new contexts.	Acquire knowledge. The focus is on the theory of science (concepts, processes, phenomena, mechanisms, principles, theories, laws, models, etc.).	Learners must: • access information from a variety of sources • select key ideas • recall facts • describe concepts, processes, phenomena, mechanisms, principles, theories, laws and models • sketch design ideas • draw simple 2D plans	Teachers should use verbs that show that knowledge of the subject is being assessed in the tasks or assessments that they set, for example: • state • name • label • list • define • describe, and any others.
	Understand, comprehend, make connections between ideas and concepts to give meaning to science and technology.	Learners must: • build a conceptual framework of scientific and technological ideas • organise or reorganise knowledge to derive new meaning • write summaries • write design briefs • develop flow charts, diagrams and mind maps • recognise patterns and trends • understand the impact of technology and science • write specifications and constraints	Teachers should use suitable verbs in tasks or assessments they set which indicate that understanding of the subject is being assessed, for example: • explain • compare • rearrange • give an example of • illustrate • calculate • interpret • suggest a reason • make a generalisation • interpret information or data • predict • select • differentiate

Specific Aim	Cognitive skill	Requirements for development of skill	Assessment of skill
Specific Aim 2: Understanding and connecting ideas Learners should have a grasp of scientific, technological and environmental knowledge and be able to apply it in new contexts.	Apply knowledge of science and technology in new and unfamiliar contexts.	Learners must be able to: • use information in a new way • apply knowledge to new and unfamiliar contexts • use knowledge to design solutions to problems, needs and wants.	Teachers should use suitable verbs in tasks or assessments they set, which assesses a learner's ability to apply knowledge, for example: • demonstrate • interpret • predict • compare • diferentiate • illustrate • solve • select. Learners need to show application of knowledge about something that they have learnt, and which they understand, in a context or situation about which they have not yet acquired specific knowledge, or they must show the use of this knowledge in a new way.
	Analyse, evaluate and synthesise scientific and technological knowledge, concepts and ideas.	Learners must be able to: • analyse information/data • recognise relationships between existing knowledge and new ideas • critically evaluate scientific information • critically evaluate issues, proposed solutions, products and processes • identify assumptions • categorise information.	Teachers should use suitable verbs in tasks or assessments they set which indicate that analysis, evaluation and synthesis are being assessed, for example: • appraise • argue • judge • select • evaluate • defend (a point of view) • compare • contrast • criticise (an argument or assumption) • differentiate • distinguish • discuss.

Specific Aim	Cognitive skill	Requirements for development of skill	Assessment of skill
Specific Aim 3: Science, technology and society Learners should understand the practical uses of Natural Sciences and Technology in society and the environment, and have values that make them caring and creative citizens.	**Note:** The skills that are linked to this Specific Aim are cognitive rather than practical and are the same as for Specific Aim 2.	Understanding the history and relevance of some scientific discoveries and technological developments	
		Relationship of indigenous knowledge to science and technology	
		The value and application of scientific and technological knowledge in industry, and the impact on the quality of people's lives and/or the environment	

Natural Sciences and Technology 'Knowledge Strands'

Natural Sciences and Technology for the Intermediate Phase has been divided into seven Knowledge Strands in the CAPS. These Knowledge Strands are used as organisers for the Physical Sciences, Life Sciences, Earth Sciences and Technology components of this integrated subject:

Subject	Knowledge Strand	Area of science
Natural Sciences	Life and living	Life Sciences
Natural Sciences	Matter and materials	Physical Sciences
Natural Sciences	Energy and change	Physical Sciences
Natural Sciences	Planet Earth and beyond	Earth Sciences
Technology	Structures	
Technology	Processing	
Technology	Systems and control	

Sequencing and progression

The Natural Sciences and Technology CAPS sets out the content to be covered for each of the Knowledge Strands for each grade as follows:

	Natural Sciences				Technology		
Strand	**Life and living**	**Matter and materials**	**Energy and change**	**Planet Earth and beyond**	**Structures**	**Processing**	**Systems and control**
Grade 4	• Living and non-living things • Structure of plants and animals • What plants need to grow • Habitats of animals	• Materials around us • Solid materials	• Energy and energy transfer • Energy around us • Energy and sound	• Planet Earth • The Sun • The Earth and the Sun • The Moon	• Term 1: Structures for animal shelters • Term 2: Strengthening materials • Term 2: Strong frame structures		• Term 3: Movement energy in a system • Term 4: Rocket systems
Grade 5	• Plants and animals on Earth • Animal skeletons • Food chains • Life cycles	• Metals and non-metals • Uses of metals	• Stored energy in fuels • Energy and electricity • Energy and movement	• Planet Earth • Surface of Earth • Sedimentary rocks • Fossils	• Term 1: Skeletons as structures	• Term 2: Processing materials • Processed materials	• Term 3: Systems for moving things
Grade 6	• Photosynthesis • Nutrients in food • Nutrition • Ecosystems and food webs	• Solids, liquids and gases • Mixtures • Solutions as special mixtures • Dissolving • Mixtures	• Electric circuits • Electrical conductors and insulators • Mains electricity	• The solar system • Movements of the Earth and planets • The movement of the Moon		• Term 1: Food processing • Term 2: Processes to purify water and water resources	• Term 3: Systems to solve problems • Term 4: Systems for looking into space • Systems to explore the Moon and Mars

It is recommended in the CAPS that teachers teach the Natural Sciences Knowledge Strands in the sequence mapped out below for all three grades:

1. Life and living
2. Matter and materials
3. Energy and change
4. Planet Earth and beyond

Each term also includes a Technology strand (terms indicated in table on page A14) and at least two Technology strands are developed in each grade.

This Natural Sciences and Technology course follows the recommended sequence above.

Time allocation for Natural Sciences and Technology

Time allocation for Natural Sciences and Technology in the Intermediate Phase:	**3½ hours per week**
Time allowed for curriculum to be completed	38 weeks
Time allowed for end of year examinations	2 weeks
Total teaching time per school year	**40 weeks**

The allocated time per topic in the CAPS is an indication of the weighting of that topic for allocation of marks in tests and examinations.

Seven hours per term must be used for formal and informal assessment (see CAPS p. 15).

Classroom management

With the learners, create a set of rules for classroom behaviour. Agree together what the rules of the classroom are and write the rules on a poster, which can be displayed in the classroom. State the rules in a positive way, for example, 'We listen quietly when others speak'.

You may find that situations arise which you did not consider when creating the rules. In these instances, if it is necessary to create a rule for it, add it to the rules. Rules may vary slightly, depending on the activities you are doing, for example, a classroom theory lesson *versus* a practical lesson *versus* an outdoors lesson *versus* a class outing.

Learners must also be made aware of the repercussions of breaking the rules. When rules are broken, follow through with a suitable reprimand or punishment. It is important that rules are applied consistently. This reinforces the effectiveness of the rule in that the learner knows what to expect. Most learners are aware of the dynamics of power in the classroom. However, there are learners who will try and see how far they can push you.

If you have a difficult learner/s in your class, approach your colleagues or principal for guidance. Some of them may have experience dealing with a similar situation or may know the learner/s involved and know how to address the situation constructively. It is important that this be done in a positive way. The learner must

be protected from being stereotyped as an ill-disciplined learner otherwise he or she will always perpetuate that behaviour.

Here are some ideas or tools to assist with classroom management:

Preparation

Prepare more than you need to for the day's lessons. Create additional worksheets on the topic you are working on, so that if learners complete their work sooner than expected, they may do the additional worksheet. It will keep them occupied and less likely to disrupt the class. This is a good opportunity to create enrichment activities.

Resources

Create a secure storage space where you store collected resource material, equipment and tools for investigations and projects. While it is not ideal to have to use improvised equipment, teachers should improvise and encourage learners to collect materials that could be used for making technology models. Plant materials for investigations could be obtained from the school grounds if appropriate plants are planted there in advance and animal material can be purchased from the local butcher at a reasonable cost.

Group or pair work

Throughout this course, learners will work in a variety of ways – sometimes on their own, sometimes in pairs or in small groups. Providing guidance for your learners in class discussions is important. Introduce each topic or activity to them by looking at what is required together and finding out what they know already. Before they get on with an activity, make sure that:

- everybody knows what they have to do and everybody knows whether they are to work on their own, in pairs or in groups
- if working in pairs or groups, the learners should not find themselves with the same partners or group members each time; this will help to avoid groups that are constantly disruptive
- they have the resources to carry out the activity
- you agree on how the learners will get your attention if they need help
- the learners have an idea of how much time the activity should take
- they understand how they will be assessed for the activity.

Organising the classroom

Find a way to organise the class so that the learners can work comfortably in the different modes (alone, in pairs and in groups). Remember that if the group size is too large then some learners may sit back and let others do all the work. There is a danger of these learners becoming bored and disrupting the rest of the class too.

It is a good idea to keep some wall and shelf space for displaying learners' work. Put up a representative sample of the class's work – not just the best ones.

You can use posters that are relevant to the subject, topic or skill that you are teaching to ignite the learners' interest in the subject and make the classroom more engaging. Posters and resources are obtainable from many organisations and institutions and are often free.

Safety

All the activities in this course have been designed with the learners' safety in mind, however, you will still need to be careful when they work outside, or with tools, science equipment, chemicals and heat. The following guidelines will help you to ensure that the environment is safe for learners to explore:

- Check the learners' health records so that you are aware of those who have allergies and other health problems.
- Tell the learners that they should never taste anything unless you give them permission to do so.
- Alert learners to possible dangers before they begin any activity.
- Remind learners not to run when using a sharp object, nor to point it at someone close to them.
- Always let learners be involved in cleaning up. Allow sufficient time for this to be done properly and make sure that spills are cleaned up immediately or they could lead to accidents.

These are just a handful of ideas to manage your classroom. Speak to your colleagues about effective methods they use in their classrooms.

Resources for Natural Sciences and Technology

Every learner should have a textbook and an exercise book, as well as sufficient workspace and equipment to carry out investigations, and design and make things.

Schools must make every effort to ensure that essential equipment is provided, but where the proper equipment is not available, teachers should improvise, as it is important for learners to have the experience of carrying out investigations and for learners to make their own technology models in order to develop science and technology skills. In this course we have tried to make use of basic equipment and consumables that can easily be obtained from recyclable sources.

The list of resources that should be available for each activity are listed at the beginning of each topic and with each practical activity and technology project in Section B of this Teacher's Guide.

Language skills across the curriculum

Natural Sciences and Technology teachers should be aware that they are also engaged in developing reading and writing skills when teaching their subject. This is important when teaching learners for whom the Language of Learning and Teaching (LOLT) is not their home language. These skills can be developed by providing learners with the opportunity to read scientific and technological texts, and write reports, paragraphs and short essays in the context of learning science and technology.

Assessment

Assessment is a continuous, planned process of identifying, gathering and interpreting information about the performance of learners, using various forms of assessment. It involves four steps:

- generating and collecting evidence of achievement
- evaluating this evidence
- recording the findings
- using this information to understand and thereby assist the learners' development in order to improve the process of learning and teaching.

Formal and informal assessment

Two types of assessment need to be done:

- informal (Assessment *for* Learning)
- formal (Assessment *of* Learning).

In both cases, regular feedback should be provided to learners to enhance the learning experience.

Process and purpose of assessment

Assessment is a process that measures individual learner's attainment of knowledge (content, concepts and skills) in a subject by collecting, analysing and interpreting the data and information obtained from this process to:

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

Assessment should be mapped against the content and intended aims specified for Natural Sciences and Technology. In planning your informal and formal assessments, it is important to ensure that in the course of a school year:

- all of the subject content is covered
- the full range of skills is included
- a variety of different forms of assessment are used.

Barriers to learning and assessing

All learners should have the opportunity to experience success – even learners who may be experiencing barriers to learning. Alternative strategies may need to be applied to accommodate learners with special needs, such as more time, enlarged text, use of information communication technology, or the use of scribes. The use of alternative assessment relates to the change in the form of assessment used to accommodate all learners. It is important to vary the assessment strategy appropriately.

The section on Inclusivity on page A5 of this Teacher's Guide could give ideas on how to overcome such barriers.

Informal assessment (daily assessment)

Assessment for learning has the purpose of continuously collecting information on a learners' achievements that can be used to improve their learning. Informal assessment is a daily monitoring of learners' progress. This is done through observations, discussions, practical demonstrations, learner-teacher conferences, informal classroom interactions, etc. Informal assessment may be as simple as stopping during the lesson to observe learners or to discuss with learners how learning is progressing. Informal assessment should be used to provide feedback to the learners and to inform planning for teaching, but need not be recorded. It should not be seen as separate from learning activities taking place in the classroom.

You can mark these assessment tasks, or let the learners mark their own or another learner's task. Self- and peer assessments actively involve learners in assessment. This is important as it allows learners to learn from and reflect on their own performance.

The results of the informal daily assessment tasks are not formally recorded unless you wish to do so. The results of daily assessment tasks are not taken into account for promotion and certification purposes. Informal, ongoing assessments should be used to scaffold the acquisition of knowledge and skills and should be the stepping stones leading up to the formal tasks in the Programmes of Assessment.

Formal assessment

Formal Assessment Tasks are all the tasks that make up a Formal Programme of Assessment for the year. They are marked and formally recorded by you for progression purposes. All Formal Assessment Tasks are subject to moderation for the purpose of quality assurance and to ensure that appropriate standards are maintained.

Formal assessment provides you 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, demonstrations, performances, etc. Formal Assessment Tasks form part of a year-long formal Programme of Assessment in each grade and subject.

Very important: The cognitive demands of assessment used should be appropriate to the age and developmental level of the learners in the grade. Assessments in Natural Sciences and Technology must cater for a range of cognitive levels and abilities of learners within this context. The assessment tasks should be carefully designed to cover the content of the subject, as well as the range of skills that have been specified under the Specific Aims. The design of these tasks should therefore ensure that the full range of content, and skills are assessed within each year of the Intermediate Phase. The Specific Aims, the topics and content, and the range of skills must be used to inform the planning and development of assessment tasks.

The tables below and on page A21 indicates how appropriate weighting of different cognitive levels can be ensured.

Weighting of cognitive levels for the assessment of content in Grades 4, 5 and 6

Setting tests and tasks for different cognitive levels	Knowing science and technology	Understanding science and technology	Applying scientific and technological knowledge	Evaluating, analysing, synthesising scientific and technological knowledge
Percentages indicating the proportion of low, middle and high order questions in tasks, tests and exams	50%	35%		15%
Useful verbs to use when setting questions	State Name Label List and others ...	Explain Describe Compare Plan Rearrange Give an example of and others ...	Predict Compare Design Use knowledge to demonstrate and others ...	Evaluate Suggest a reason Interpret and others ...

Knowledge Recall	Understand	Apply	Evaluating	Analysing	Synthesising
50%	**35%**		**15%**		
LOW	**MIDDLE**		**HIGH**		
Count Define Identify Label List Match Name Outline Point out Quote Recite Repeat Reproduce Select State Trace	Classify Compare Convert Discuss Distinguish Define Describe Estimate Explain Generalise Give examples Illustrate Infer Interpret Match Paraphrase Plan Restate Rearrange Rewrite Select Summarise Translate	Change Compute Construct Demonstrate Draw Illustrate Predict Relate Solve Use	Breakdown Differentiate Discriminate Investigate Relate Separate	Arrange Combine Compile Construct Create Design Formulate Generalise Generate Group Integrate Organise Summarise	Appraise Conclude Contrast Critique Criticise Decide Evaluate Grade Justify Interpret Support Recommend

Note:

- These cognitive skills apply to all three Specific Aims: Knowing and doing Science and Technology, and Science and Technology and society.
- A single formal class test in a term will not necessarily provide the most accurate and reliable evidence of every learner's performance. As far as possible, teachers should try to let learners write more than one class test per term in order to get a better picture of the abilities of the learners in the class. One formal class test per term is the minimum number that must be recorded.

Suggested mark weighting for Grade 6 June exam

	Topics	Cognitive levels			Teaching time in weeks	Suggested mark allocation
		Low 50%	Middle 35%	High 15%		
TERM 1 Life & Living	Photosynthesis				**$2\frac{1}{2}$ weeks**	**13**
	Nutrients in food				**$1\frac{1}{2}$ weeks**	
	Nutrition				**$1\frac{1}{2}$ weeks**	
	Food processing				**$2\frac{1}{2}$ weeks**	**12**
	Ecosystems and food webs				**2 weeks**	
	10 weeks					
TERM 2 Matter & Materials	Solids, liquids and gasses				**$\frac{1}{2}$ week**	**11**
	Mixtures				**1 week**	
	Solutions and special mixtures				**$2\frac{1}{2}$ weeks**	
	Dissolving				**1 week**	**14**
	Mixtures and water resources				**$2\frac{1}{2}$ weeks**	
	Process to purify water				**$2\frac{1}{2}$ weeks**	
	10 weeks					
	TOTAL	25 marks	17 marks	8 marks		**50 marks**

Suggested mark weighting for Grade 6 November exam

	Topics	Cognitive levels			Teaching time in weeks	Suggested mark allocation
		Low 50%	Middle 35%	High 15%		
TERM 3	Electrical circuits				**2½ weeks**	**11**
	Electrical conductors and insulators				**2 weeks**	
	Systems to solve problems				**2½ weeks**	**14**
	Mains electricity				**3 weeks**	
	10 weeks					
TERM 4	The solar system				**2½ weeks**	**15**
	Movement of the Earth and planets				**1 week**	
	The movement of the Moon				**1 week**	
	Systems for looking into space				**1 week**	
	Systems to explore the Moon and Mars				**2½ weeks**	**10**
	8 weeks					
	TOTAL	25 marks	17 marks	8 marks		**50 marks**

Sample exam and tests

The *Revision: Test* features at the end of each term in the Learner's Book provide learners with a range of questions that can be used for revision and preparation for exams and tests. Answers for these questions are provided in the lesson guidelines.

A sample end-of-year internal exam and sample tests for each term, as well as marking memorandums and rubrics, are included in Section C, and may be photocopied for use with this course. The sample exam has been set in accordance with the guidelines in the CAPS. Refer to the CAPS document for more information if you prefer to set your own exam paper.

Rating scale

Codes and percentages for reporting in Grades R–12

Rating code	Description of competence	Percentage
7	Outstanding achievement	80–100
6	Meritorious achievement	70–79
5	Substantial achievement	60–69
4	Adequate achievement	50–59
3	Moderate achievement	40–49
2	Elementary achievement	30–39
1	Not achieved	0–29

Formal Programme of Assessment

The Programme of Formal Assessment table on this page shows what is required for formal assessment for the year.

Formal assessment requirements for Natural Sciences and Technology Grade 6

Refer to the assessment section of the CAPS for further guidelines on setting balanced tests and exams, and for the specific requirements for each type of assessment task.

Also see Section C for sample exam papers and additional examples of questions that can be used for setting your own tests and exams.

Formal Programme of Assessment for Grade 6

Formal assessments	Term 1	Term 2	Term 3	Term 4	Total marks for the year	Total % for the year
School-based assessment	1 Test on Term 1 work (20 marks 1 selected Practical Task (15 marks)	1 Exam or Test on work from Terms 1 & 2 (50 marks) 1 selected Practical Task (15 marks)	1 Test on Term 3 work (20 marks) 1 selected Practical Task (15 marks)	1 selected Practical Task (15 marks)	150 marks	75%
Exams (60 minutes)				Exam on work from terms 3 & 4 (50 marks)	50 marks	25%
Total number of formal assessments	**2**	**2**	**2**	**2**	**8 assessments (200 marks)**	**100%**

For guidelines on the minimum mark allocation prescribed for tests, tasks and examinations for each grade please see marks given in brackets in the table above and in the table on page A21.

Records of learner performance should provide evidence of the learner's progression within a grade and his or her readiness to progress to the next grade.

Learner performance should be communicated to learners, parents, schools and other stakeholders by means of report cards, parents' meetings, school visitation days, parent-teacher conferences, phone calls, letters, class or school newsletters.

Learners' work should be displayed all over the classroom and school, if possible.

How to use this course with the Curriculum and Assessment Policy Statement for Natural Sciences and Technology

Structure of course according to CAPS

- This *Study & Master* Natural Sciences and Technology course consists of a Learner's Book, which has been carefully structured to match the requirements of the CAPS, as well as this Teacher's Guide that provides step-by-step guidance on how to introduce and teach the topics and activities in the Learner's Book.
- This *Study & Master* Natural Sciences and Technology course has been designed according to the contents and sequence of the CAPS to make it easier for teachers to develop their own teaching plans in accordance with the CAPS guidelines.
- The features of this *Study & Master* Natural Sciences and Technology course, outlined below, ensure that teachers can meet the CAPS requirements by following this course.

Integration with general aims and principles of the South African curriculum

- **Examples** and **case studies** have been selected to reflect the general aims and principles of the South African curriculum, as well as the specific aims of the science curriculum. For example, there are examples that relate the content to the work that different types of scientists do. Inclusivity is emphasised, for example by making learners aware of how people with different disabilities would use their senses. Environmental and social justice form the basis for many of the real-life examples throughout, with an emphasis on practical involvement, for example in starting a vegetable garden or recycling project.
- The variety of activities allow for a wide range of opportunities to develop **language across the curriculum**, especially with regard to reading and writing, for example by letting learners read real-life examples and articles and write short reports.

Expanded Contents provides an overview of the CAPS

- The **Expanded Contents** provides an overview of the requirements of the CAPS for Natural Sciences and Technology in terms of content and pacing. It can also serve as a Work Schedule for the teaching of Natural Sciences and Technology.

Weighting and sequencing

- The course structure has been aligned to the recommended weighting of different Topics in the CAPS, in terms of numbers of hours.
- The structure has been planned to allow for a progression of knowledge acquisition across Topics. Although we would therefore recommend that you follow the structure for the year in the sequence as presented, you may of course make whatever adjustments you may regard as necessary to match your local and

classroom situation. For example, if you live in Namaqualand, you may want to devote time during spring to topics related to Life and living so that you can link in the natural floral wonders of your region as part of your teaching plan.

- On average, one page in the Learner's Book reflects roughly one hour of recommended teaching time in the CAPS. You may however find that some aspects require more teaching time, and you should therefore do your own pace planning to ensure appropriately weighted coverage of the content during the course of the year.
- Because the weighting for Technology includes allowance for the completion of Technology Practical Tasks in class time, fewer Learner's Book pages are usually allocated to the Technology topics than reflected in the recommended number of hours.

Terms, Topics and Units = CAPS Topics and Sub-topics

- The structure for each **Term** reflects the coverage of the different Knowledge Strands as in the CAPS.
- Each **Term** in the Learner's Book and corresponding Teacher's Guide is divided into **Topics** and **Units** that are structured according to the recommended sequence of Topics and Sub-topics in the CAPS.

Establishing links across topics

- The Knowledge Strands, as well as the Topics and Sub-topics in the CAPS, are used throughout as an organising tool for the subject content. However, as the CAPS emphasises, learners need 'to make links to related Topics to help them achieve a thorough understanding of the nature of and connectedness in science and technology. Links must also be made progressively, across grades to all Knowledge Strands.'
- For this purpose, *Arrow note* features have been introduced throughout to help learners see the links between different themes, both in terms of what they have already learnt and what they will still be learning about later. The *What do you already know*? features for baseline assessment at the start of Topics also help to reinforce this important aspect.
- *Flash facts* features provide extra interesting bits of information to stimulate interest in the topics being studied. They can be used as talking points during class discussions.

Concept development

- Keywords are introduced and explained throughout in the text, and are highlighted in colour in the text where they are first explained.
- *Keyword* boxes in the margin list these words where they are first explained, as a reminder for learners to make sure that they understand the meaning of these words.

- The *Word list* feature at the back of the Learner's Book gives learners the opportunity to practise their dictionary skills by giving short definitions for key words, along with page references to the pages where these words are first explained. You can develop learners' abilities in this regard by making the looking up of words in the *Word list* a regular part of your teaching routine. For example, as a warm-up activity at the start of a lesson, you can do a short class quiz to see which groups can look up words the quickest.

Practical skills development

- Skills development, as outlined in the Specific Aims of the CAPS, forms an integral part of the structure of the course.
- In addition to general integration of skill-related activities and content, the course includes *Science and technology skills* features that introduce and reinforce key skills throughout the course.
- These skills features also help to make learners aware of the real scientific purpose of the activities that they are doing. For example, many teachers dread group work activities that focus on discussion, as it could easily deteriorate into idle chatter if not properly supervised. The skills feature on group work however makes learners feel like 'real' scientists when doing group work by explaining how scientists often work together to make important scientific discoveries.
- In the development of skills and their application in activities, the emphasis in the course is on providing practical ideas for using everyday materials where scientific equipment may not be available. For example, empty cooldrink bottles are suggested as containers for growing plants, and glass storage jars instead of glass beakers for relevant experiments.
- *Safety first*! features are used throughout to emphasise the importance of working safely, for example, when doing experiments or when collecting insects for study.

Activities for concept development and assessment

- Activities match the recommended activities in the CAPS and also allow for the progressive development, consolidation, and informal and formal assessment of knowledge and skills that are required by the CAPS.
- *What do you already know*? features at the start of new topics, allow for baseline assessment of the following:
  - what learners have already learnt in earlier topics or grades
  - what general background knowledge learners already have on familiar aspects of topics.
- *How are you doing*? features at the end of Topics serve as a reminder to reflect on what learners can remember of what they have learnt in each Topic before introducing a new Topic. Encourage learners to ask questions about aspects that they are still unsure of, and do revision as necessary, either with individuals or groups of learners, or with the class as a whole.

- *Practical Tasks* are explained in a way that allows these tasks to be used as options for formal assessment, as explained in the section in the Teacher's Guide.
- *Revision: Test* questions at the end of each term help learners to review the work for the whole term, and to prepare for tests and exams.
- *Enrichment tasks* are suggested at the end of each term to allow for extension work, and further ideas for extension and remediation are provided in the Teacher's Guide throughout the course.
- *Worksheets* that may be photocopied for use with this course are provided in Section C of the Teacher's Guide for activities where learners may, for example, need them to record Practical Tasks, or for additional enrichment activities.

Additional teacher support in the Teacher's Guide

- The Teacher's Guide comes in loose-leaf folder form. This allows for convenient filing of additional information in one place with the general teaching information in the Teacher's Guide.
- The Teacher's Guide provides step-by-step guidelines for introducing the different Topics and Activities in the Learner's Book.
- Background information, such as relevant websites, is included where relevant.
- Answers are provided for all activities.
- Formal and informal assessment guidelines are included in the lesson notes where relevant. Also refer to the section on Assessment in this Introduction.
- Assessment tools, such as rubrics and checklists, which may be photocopied for use with this course, are provided in Section C for Formal Assessment Tasks, as well as for informal assessment where relevant.

Section B: Teaching guidelines

Term 1: Natural Sciences: Life and living
Technology: Processing

Term 2: Natural Sciences: Matter and materials
Technology: Processing

Term 3: Natural Sciences: Energy and change
Technology: Systems and control

Term 4: Natural Sciences: Planet Earth and beyond
Technology: Systems and control

TERM 1

Natural Sciences: Life and living Technology: Processing

TERM 1
Natural Sciences: Life and living Technology: Processing

TOPIC 1: Photosynthesis
Unit 1.1 Plants and food
Unit 1.2 Plants and air

TOPIC 2: Nutrients in food
Unit 2.1 Food groups

TOPIC 3: Nutrition
Unit 3.1 Balanced diets

TOPIC 4: Food processing
Unit 4.1 Need for processing food
Unit 4.2 Methods for processing food

TOPIC 5: Ecosystems and food webs
Unit 5.1 Different ecosystems
Unit 5.2 Living and non-living things in ecosystems
Unit 5.3 Food webs

Topic 1

Photosynthesis

$8\frac{3}{4}$ hours

Curriculum content and concepts

Plants and food

- Plants make their own food (glucose sugar) by a process called photosynthesis
- Photosynthesis takes place mainly in the leaves
- During photosynthesis the plant uses sunlight energy, carbon dioxide (from the air) and water to make glucose sugar
- Plants change some of the glucose sugar into starch which they store in their leaves, stems and roots, flowers, fruits and seeds

Plants and air

- During photosynthesis the plant uses carbon dioxide from the air and gives off oxygen into the air
- Animals, including people, use the oxygen from the air for breathing and give out carbon dioxide which is used by plants for photosynthesis

What do you already know? LB p. 10

Learners work on their own.

1. Energy from the Sun, carbon dioxide and water.
2. There would be no life.

Unit 1.1 Plants and food LB p. 10

Resources needed

- Glucose powder, maize flour, iodine solution, plastic droppers, examples of foods such as cooked rice, flour, potato, bread, oil, boiled egg, cheese
- Video clips from the Internet.

Teaching the lesson

Photosynthesis is an important process that must be taught with the aim of further studies in Senior Phase and FET studies. A mind map or flow chart will be ideal to instruct the learners. Learners must be able to draw or design their own diagram. Learners must understand that plant leaves are like food factories that need raw products such as water, carbon dioxide and sunlight energy to make food. The raw products are transported to the leaves, while the produced food is transported to different parts of the plant. The leaves are the "factory part of the plant", e.g. roots, stems, leaves, fruit and flowers, where it is stored. Humans and animals eat these parts of the plant to obtain their energy.

ACTIVITY 1 Draw and write about photosynthesis LB p. 11

Learners work on their own.

1. Learners create a mind map to explain what happens during photosynthesis. Their mind maps should include the main elements of the process: plant uses energy from the Sun, carbon dioxide from the air and water to make food (glucose).
2. Sunlight, water, carbon dioxide
3. They store their food in their leaves, stems, roots, flowers, fruits and seeds.

ACTIVITY 2 Compare glucose sugar (such as glucose sweets) and starch (such as maize flour) LB p. 11

Learners work in groups.

Make sure you have all the necessary equipment and other items for the activity. You will need to give each group glucose and starch to examine. Learners must look at the colours of the glucose and starch and they must taste them. Remind learners that everyone needs to taste and that they must not take big amounts.

Learners compare the glucose and starch in a table like the one given in the Learner's Book.

In science it is important for learners to be able to compare one thing with another. In this case they will compare the characteristics of glucose and starch. NB: Colour and taste will depend on the products that the teacher chooses to supply to the learners. Starch is normally a white powder and tasteless. Glucose sweets may have different colours and taste sweet. An example of an answer may look as follows:

	Colour	**Taste**
Glucose	white/yellow/orange, etc.	sweet
Starch	white	tasteless

ACTIVITY 3 Use iodine solution to test foods for starch LB p. 12

Make sure you are prepared for the activity. You will need to have iodine solution, starch, cooked rice, flour, potato, bread, oil, boiled egg and cheese.

Part 1: Use iodine solution

Give each group some starch as well as iodine solution.

1. Learners place a drop of the iodine solution on the starch.
2. The starch becomes blue-black in colour.
3. Iodine solution can be used to test foods for starch.

Part 2: Test foods for starch
Give learners some more iodine solution as well as cooked rice, flour, potato, bread, oil, boiled egg and cheese.

1. Learners' answers will vary.
2. Learners experiment with the iodine solution and the various foodstuffs. They must observe and record what happens.
3. Learners then compare their answers in Question 1 to the results of the investigation in Question 2.
4. Learners' answers will vary.
5. Rice, flour, potato and bread are starches. Oil, boiled egg and cheese are not starches.

Teaching tip:
Learners can design their own table based on the example in Activity 2. It is important for learners to demonstrate the scientific skills they have mastered throughout the year.

Example of a table:
Title: Foods with starch and foods with no starch

Starch	No starch
rice flour potato bread	oil boiled egg cheese

Learners must now interpret the table and draw a conclusion. For example, rice, flour, potatoes and bread contain starch. Oil, boiled egg and cheese contain no starch.

Unit 1.2 Plants and air

LB p. 13

Resources needed

- one small plant
- two candles
- matches
- two bell jars
- two rubber stoppers
- Vaseline
- clear lime water
- beaker or transparent container
- a straw

Teaching the lesson

Learners must learn that plants keep our air clean and fresh. They remove carbon dioxide from the air and release oxygen into the air. The oxygen is used by people and animals to breathe.

Teaching tip:
Learners must realise the importance of nature conservation, the natural parks in their environment and calendar events like Arbor Day. The teacher should use this opportunity to emphasise the importance of plant protection.

ACTIVITY 4 Plants produce oxygen LB p. 13

Learners can perform Activities 4 and 5 in pairs, groups or individually. If this is not possible, the teacher can set up the apparatus and demonstrate the experiment. Learners can observe and record their observations. When performing this experiment, the learner's ability to follow instructions will be tested. They must be able to make accurate observations and draw correct conclusions. They must also be exposed to the scientific terminology such as *bell jars*, *rubber stoppers*, *observations* and *conclusions*.

1. The candle went out sooner than the candle with the plant next to it.
2. The candle burned longer.
3. In the bell jar without the plant, the flame went out because there was no oxygen in the bell jar. In the bell jar with the candle and the plant, the candle burned longer because the plant produced oxygen.
4. This makes sure that no gas escapes or enters the bell jar.

ACTIVITY 5 Test for carbon dioxide LB p. 14

Learners work in pairs.
Give each pair the necessary apparatus.

1. Learners blow air into the clear lime water.
2. It turns milky.
3. We breathe out carbon dioxide.

Topic 2 Nutrients in food

$5\frac{1}{4}$ hours

Curriculum content and concepts

Food groups

- Foods can be grouped according to their functions in the body and the main nutrients they supply:
  - Foods for energy – carbohydrates
  - Foods for growth and repair – proteins
  - Foods for storing energy (in the form of body fats) and providing insulation and protection for nerves and organs – fats and oils
  - Foods for building bones and teeth, and maintaining a healthy immune system – vitamins and minerals
- Most natural foods contain a mixture of more than one nutrient group
- Most processed (manufactured) foods have added salt, sugar, preservatives, flavourings and colourings.

Unit 2.1 Food groups LB p. 15

Resources needed

- Drawings of different food types and food packaging
- Different foods
- Iodine solution
- Potato, slice of white bread, egg (separated)
- Box of surgical gloves

What do you already know? LB p. 15

This is a baseline assessment to determine learners' existing knowledge on healthy diets.

Learners work with another learner.

Learners must be able to distinguish between healthy and unhealthy diets. It is important that learners understand the importance of healthy eating habits and a balanced diet. They possess prior knowledge that can be useful in introducing the topic. Learners must be able to distinguish among the different food types, examples of each type and their biological importance. The danger of unhealthy eating habits and possible disease must be highlighted.

1. Yes. She looks healthy.
2. a) The girl. She is eating fruit.
   b) The boy because he is eating junk food – burger, chips and soda

c) Learners' answers will vary. In general, sweet unhealthy food can give a short burst of energy but this is not long-lived. Healthier food like fruit and wholegrain cereals also give the body energy but in a more sustained manner.

Teaching the lesson

Classification of food types LB p. 16

Go through the table with the learners indicating that there are five different food groups. Learners must be able to distinguish between the major food groups. They must also be able to classify or sort lists of food products into the main food groups. The opportunity is there for learners to identify, interpret, sort, classify and tabulate any data on food they are supplied with.

Learners must know the importance of each food group. The table of the food groups can be used to revise the requirements for a table. Use the drawings to highlight the relevant food groups. Ask the learners to summarise the most important facts on pages 17, 18 and 19 in a colourful mind map in their exercise books.

ACTIVITY 1 Sort foods and create a table LB p. 20

Learners work on their own.

1. to 2. Create or photocopy the table provided on page C9 for each learner. They will need to take it home with them and record their meals for the week. Make sure learners are very clear on what each food group is.
3. Learners' answers will vary. Provide guidance to help them identify realistic improvements to their diet. Handle this sensitively where you are aware of learners whose financial circumstances may affect their dietary choices.

ACTIVITY 2 Match the food to the nutrient group LB p. 20

Learners work on their own.

1. Learners examine the food types given in the Learner's Book.
2. They copy and complete the table.
3. Learners have to find two examples of natural food types at home that have more than one nutrient group.
4. Learners research two food types and write a paragraph on them.

Understanding food labels LB p. 21

Learners must be able to analyse food labels for their nutritive value. They must know what labels tell us about the balance between the different food groups in a product. Some foods may have extra sugar and fat to make them tastier, but this means that they are less healthy. Fat-free products may contain less fat, but more sugar which is unhealthy.

Explain that legislation now forces suppliers to indicate on their packaging what the ingredients and nutritional value of a product are. There is still much ignorance amongst buyers as to what certain terminology actually means.
Ask the learners to collect three food labels for the following activity.

ACTIVITY 3 Read food labels LB p. 22

Learners work with another learner.

1. Learners collect three food labels from the packaging of food they eat.
2. Ask a few learners to bring their labels to the front of the class. Read the labels to the class and tell them what information the labels give.
3. Learners look at their examples they have brought from home.
4. Learners then create a table in which they compare the nutritional content of the three food products.
5. Learners' answers will vary.
6. Learners' answers will vary.

Topic 3

Nutrition

$5\frac{1}{4}$ hours

Curriculum content and concepts

Balanced diets

- A diet refers to the selection of foods we eat every day
- A balanced diet contains sufficient quantities of food from all four nutrient groups, as well as water and fibre
- Some diseases can be related to diet

Unit 3.1 Balanced diets LB p. 23

Resources needed

- Pamphlets, charts and posters
- Lists of different diets
- Drawings and information about food-related illnesses

What do you already know? LB p. 23

This is a baseline assessment to determine learners' existing knowledge on balanced diets.

Learners work with another learner.

When teaching this topic the teacher must remember that the previous two topics already introduced the concept of balanced diets. The baseline activity provides continuity between the different topics.

1. Food provides much needed energy we need to do our work.
2. Cabbage – more nutritious, more fibre
   Chocolate – contains energy for sugar
   Learner may choose any one with a substantial reason in order to receive credit.
3. Cabbage; more nutritious, more fibre.

Teaching the lesson

The importance of a balanced diet LB p. 23

This topic provides more detail and reflects on the importance of a balanced diet. Learners will learn about the components of a balanced diet and its importance for their normal growth and development.

Read the information on pages 23 and 24 in the Learner's Book with the learners. Ask the learners what constitutes a balanced diet. Which foods would come under healthy food? Learners must know and understand the importance of a balanced diet to live a healthy life. They must know that a balanced diet consists of sufficient quantities of proteins, fats and oils and carbohydrates, as well as

vitamins and minerals. Discuss the drawing on page 24 in the Learner's Book with this in mind. Point out the proportions of each food group on the plate.

ACTIVITY 1 Assess and create a diet LB p. 25

Learners work with another learner.

1. Partners discuss Adam's diet.
2. Learners give a breakdown of the nutrient content of each meal. Breakfast: carbohydrates, vitamins and minerals, fats and oils, small amount of protein from peanut butter; Snack: carbohydrates, fats and oils; Lunch: carbohydrates, protein, fats and oils, vitamins and minerals; Snack: protein, vitamins and minerals; Supper: protein, vitamins and minerals, carbohydrates, fats and oils
3. Snack 1, Snack 2, Supper: hamburger and chips or meat pasta
4. Breakfast and supper (meat or fish, potatoes, carrots, peas and broccoli option). Yes.
5. Learners say what they would change about Adam's diet. Their answers could include: make snacks more substantial by adding a carbohydrate for energy and by reducing or replacing junk food (chocolate and crisps); add vegetables to supper to include vitamins and minerals.
6. Partners create their own dietary plan which will incorporate all the food groups and will give them sustained energy.
7. Pairs compare their plans with the rest of the class.

Different people – different diets LB p. 26

Learners must study the case study and discuss the different dietary needs of people. Ask the learners to look up the difference between a dietician and a nutritionist in their dictionaries (or use google).

Teaching tip:
The case study can also be used a comprehension exercise to test learners' ability to extract knowledge or make meaning of a written text. For example:

- Explain the difference between the work of a nutritionist and a dietician. Dieticians and nutritionists are both food and nutrition experts. They've studied how food and food supplements affect the body and your health.
- What is meant by carboloading? Eating lots of carbohydrates.
- List two vital food groups that HIV/AIDS patients need to fight the disease. Vitamins and minerals.
- What do babies need a special diet for? Growth.
- Explain why older people must eat smaller portions of food. Slower digestion. Less exercise.

Diseases that result from not eating a balanced diet LB p. 27

Learners must know that an imbalanced diet cause abnormal growth and development. It can lead to diseases like tooth decay, rickets, constipation, kwashiorkor and obesity. They must know the causes of each disease and

how they can be prevented or treated. More information on these diseases can be read at: *http://www.thirdplanetfood.com/malnutrition.htm*

Teaching tip:
Learners should read the content about diseases caused by malnutrition on pages 27 and 28 and design a mind map to distinguish between the cause and effect of the different diseases.

ACTIVITY 2 Evaluate different diets and consider diseases linked to diet LB p. 29

Learners do the activity first on their own in their exercise books and then as a class. They must prepare a list of questions as a class to ask a nutritionist. Invite a nutritionist or health worker to visit the class to tell them more about balanced diets.
Learners work on their own.

1. a) Learners will write a paragraph based on their diet analysis. The teacher will evaluate each learner's response accordingly.
   b) Learners must make suggestions based on their dietary needs.

Learners work as a class.

2. a) No. Nowadays people eat processed or junk food. Many chemicals used in food production have a negative effect on people's health. In the past, no chemicals were used. People ate natural food often directly from the garden.
   b) No. Modern technology is used to produced more food much faster. Some products are genetically modified (GMOs) and differ from the original products. The effect of GMOs on people's health is not known.
3. A balanced diet will contain sufficient amounts of protein, carbohydrates, fats, vitamins and minerals. It must also contain sufficient amounts of fibre for proper digestion. Athletes may need more protein and carbohydrates to build their muscles and provide energy.
4. a) Learners will prepare a set of questions that should be evaluated by you for relevance and substance. Asking the correct questions under specific circumstances is a skill that should be practised by all science learners. They must be taught to be inquisitive.
   b) Learners must be able to make accurate notes when listening to a speaker. This is a skill required for further studies. Make sure that you teach and assess learner's ability to make accurate notes.

How are you doing? LB p. 29

Take this opportunity to ask learners if there is anything that they do not understand in the topic. You can check their understanding by asking them some questions about the information covered in the topic. Explain anything that learners do not understand.

Topic 4

Food processing

$8\frac{3}{4}$ hours

Curriculum content and concepts

Need for processing

- Food is processed to:
  - make it edible (preparing, cooking)
  - make it last longer (preserving)
  - improve its nutrient value (fermenting)
- During processing many foods may lose some of their nutrients

Methods for processing food

- There are many different methods (ways) to process food

Unit 4.1 Need for processing food LB p. 30

Resources needed

- Drawings and information about how food is processed
- Foods for processing

What do you already know? LB p. 30

This is a baseline assessment to determine learners' existing knowledge on food processing.

1. You put them in the fridge. They will go off/sour if you leave them out of the fridge.
2. You put them in the fridge or freezer. Meat needs to be kept frozen until you use it. If you leave it out of the fridge it will go rotten.
3. We need to put vegetables with high water content in the fridge. Carrots and cabbage can be stored for a short while on the vegetable shelf or be put into the fridge. Some vegetables, such as potatoes and onions, can be stored on a shelf until they are needed.
4. We need to put vegetables with high water content in the fridge otherwise they will lose water and become limp. Carrots and cabbage and other vegetables need to be used soon after they are bought to keep the maximum nutrition.
5. No. Raw meat is harmful for the body as it contains a lot of micro-organisms that can cause illnesses. Meat needs to be cooked to kill those harmful micro-organisms.

Teaching the lesson

Need for processing food LB p. 31

Make sure learners understand what is meant by the term 'process'. Learners must understand that we process food to make it edible, last longer and to improve the nutritional value. Collect different packages of food or drawings of food. Discuss the difference between perishable and non-perishable foods with the learners. Allow learners to give reasons why food can be classified in this way and let them give more examples. They can also look in their lunch box to see if they can classify the food in there into the two groups.

Explain briefly that micro-organisms can cause food to go off, e.g. an apple that has gone brown, fruit, cheese or bread with mould on it.

ACTIVITY 1 Think about ways to process a fruit LB p. 32

Learners work in a small group.
Learners must follow the instructions in the Learner's Book.
Help learners who can't think of a fruit to process. To assist learners, you could bring examples of processed food to class and you could have books and/or posters on processing food displayed in the classroom.

Some food is not nice to eat raw and needs to be cooked to change the taste and make it more digestible. You can have raw and cooked pasta in the classroom and one of the learners can taste the difference.

We need to process food to make it last longer, especially when it is in season. Some foods are only available during certain seasons, for example peaches are only ripe towards the end of spring and in summer. We need to make the maximum use of the fruit while it is around.

Because some food loses its nutritional value if it is kept for a long time, nutrients are added to it when it is processed. Look on packaging of fruit juices or milk to see what is added to the product.

1. Learners can decide on the fruit they want to discuss in their group. Let them use something that is known to them in the area they are living. Ask learners to bring drawings of the fruit to the classroom.
2. Explain a spider diagram again to the learners. Give the learners a piece of chart paper and let them put the fruit they selected in the middle. Show them how to make use of the space available on the paper.
3. Learners discuss different products that can be made from the fruit and cut or draw the different products on the spider diagram. Help learners where necessary.
4. Display the different posters on the classroom wall and allow learners to look at the posters. Let them make notes on things that they can add to the posters. Have a class discussion afterwards.

ACTIVITY 2 What do we find inside processed food? LB p. 32

Learners work on their own.
In this activity learners read the labels. Explain difficult words to learners. Ask a few learners to share with the class what information they found on their labels.

Processing food to improve the nutritional value LB p. 33

Explain that micro-organisms can be useful in daily life but can also be harmful to the body. Micro-organisms are so small that you cannot see them with your eyes. Yeast is an example of a micro-organism that can be used in the fermentation process to make certain products and break sugars down so that can be more easily digested, but it can also be harmful, for example it causes fresh fruit to rot.

Washing hands LB p. 34

As a fun activity, you can test to see whose hands are really clean. This activity will show learners the importance of washing their hands with warm water and soap to clean their hands. This will lead to other ways to work safely with food.

Processing food can contribute to food losing some of its nutrients LB p. 34

Some nutrients (such as Vitamin C) are very sensitive to heat and light. When nutrients are exposed to heat and light they lose their nutrients. That is why it is important to use food as soon as you can after it is bought. When food is cooked some nutrients are also destroyed. Therefore if you make jam from fruit, the Vitamin C will be destroyed.

Additives are added to food to make it last longer. Some people are allergic to certain additives and that is why it is important to read the labels of processed food to check what has been added to the product. Discuss the different ways of food processing. Learners can give examples of food processed in the different methods.

Discuss indigenous ways of processing food. Learners can give their own examples of how their parents or grandparents process food to make it last longer.

Unit 4.2 Methods for processing food LB p. 35

Resources needed

- Foods for processing

Teaching the lesson

Learners need to know that there are many ways to process food. The main methods you need to cover with them are: refrigeration or freezing, drying and salting, pickling, combining. If possible, have examples of each method of processing available for learners to sample.

Indigenous ways of processing food LB p. 36

Read the information about different indigenous foods and how they are processed with the class. Ask the learners if they know of other indigenous foods and then ask them to describe how these are processed. If they do not know, ask them to find out for homework.

PRACTICAL TASK – ACTIVITY 3 Research how to process food LB p. 37

1. Bring recipe books to school, visit the library or ask learners to bring their favourite recipe to school.
2. The recipes that the learners bring to school can be exchanged between the learners and they can make their own recipe books, or they can use recipes in the books to make their books.
3. Discussed how the food is processed in the recipes.
4. If you have facilities, learners can make their favourite recipe or they can use the recipes in the Learner's Book.

Learners evaluate the food that was made and talk about ways to improve it.

ENRICHMENT Locate countries on an atlas LB p. 39

Learners work as a class.
This is meant to be a fun activity. If you have time and you feel your learners would enjoy the activity, allow them to do the task. They will need a few atlases or a large map of the wall to find the countries listed in the artwork on page 39.

Topic 5

Ecosystems and food webs

7 hours

Curriculum content and concepts

Different ecosystems

- An ecosystem is an area where living and non-living things depend on each other in many different ways
- There are many different ecosystems such as rivers, mountains, the sea, rocky shore, ponds, wetlands, grasslands, forests and deserts, which support different kinds of living things

Living and non-living things in ecosystems

- In an ecosystem there are certain relationships between living things (plants, animals or people, micro-organisms), and non-living things (air, water, sunlight, soil) in a particular area

Food webs

- In an ecosystem plants and animals are connected by their feeding; this is called a food web
- Plants (producers) produce food for themselves and animals
- Animals (consumers) are herbivores, carnivores or omnivores
- Micro-organisms (decomposers) break down dead plant and animal matter and return nutrients to the soil

Unit 5.1 Different ecosystems LB p. 40

Resources needed

- Drawings of ecosystems such as rivers, mountains, the sea, rocky shores, ponds, wetlands, grasslands, forests and deserts

Teaching the lesson

Learners must be able to distinguish between the different ecosystems. They must know the main features that characterise each ecosystem, e.g. plants, animals and rainfall. Learners must study the text on pages 40 to 47. The teacher should facilitate this process carefully and make sure that learners know the main characteristics of each ecosystem. Then the teacher can assess the learners' knowledge via the next activity. Remember at this level we look for main trends and not too much detail. Focus on key knowledge items. The skill is for learners to read and understand what they read.

ACTIVITY 1 **Find out more about an ecosystem** **LB p. 47**

Learners work in groups.
Learners choose an ecosystem that they've read about, and find information about the types of plants and animals found in that ecosystem. Once they've gathered all the information, they can present their information as a short oral presentation, or in a colourful poster.

Unit 5.2 Living and non-living things in ecosystems LB p. 48

Teaching the lesson

The best way to teach this topic is to take learners outside the classroom onto the school grounds and have them investigate a small plot (2 m × 2 m). They need to identify the living (plants, animals) and non-living things (Sun, soil, water, gases, wind, temperature, etc.) in their plots. Then they have to look at interactions between the living and non-living things. For example, plants use the energy of the Sun, carbon dioxide and water to make food. Insects or birds get their food from the plants. Some birds eat the insects or worms in the plot. From this discussion they must then construct a food chain and a food web if possible. We can teach them the difference between natural and human-made ecosystems and at the same time highlight the factors that threaten the ecosystem. Learners can come up with suggestions how to prevent or deal with the threats.

ACTIVITY 2 **Consider how humans affect ecosystems** **LB p. 48**

Learners work on their own.

1. a) There is toxic waste running into the river. The crops are being sprayed with harmful pesticides. People are polluting the river.
   b) They should redirect the toxic waste pipes to a safer place where they can dispose of it better with no harm caused to the environment. They could use other methods of farming practices that won't harm ecosystems. The people should have proper areas where they throw away their solid waste.
2. a) – b) Learners list ways in which people damage the air and soil in ecosystems, and give suggestions on how to prevent damage to the environment in each scenario.

Unit 5.3 Food webs LB p. 50

Teaching the lesson

Learners must know that ecosystems are dynamic systems with much on-going activity. In the previous unit they learnt about the living and non-living things in an ecosystem. In this unit they need to interrogate the interactions between the living and the non-living environment, and between the different living organisms. These relationships are referred to as food chains and food webs. Teach them about the interdependency of the living organisms and that the one cannot exist without the other. Learners must know the difference between a food chain and a food web.

ACTIVITY 3 Work with food chains LB p. 50

This activity determines learners' existing knowledge.
Learners work as a class.

1. a) Plants use the sunlight to make their own food.
   b) The animals eat the plants and the person in turn eats the animals.
2. Sun → maize plant (make food) → cattle eat (eat maize seeds) → girl (eats meat)

Food chains in nature LB p. 51

Learners must be able to identify and describe food webs in nature, especially their own environment. They must understand the flow of energy from the Sun through the plant to animals and back into the environment via the decomposers. Remember the physics LAW of ENERGY: *Energy cannot be destroyed or created, but it can be passed from one level to another and released back into the environment.*

ACTIVITY 4 Compare and explain food chains LB p. 53

Learners work with another learner.

1. a) Grass uses sunlight energy to make food. The dead zebra was a herbivore that ate the grass. The lion gets its energy from the zebra.
   b) The second food chain is represented by the hyenas or the vultures waiting for the lion to finish so that they can feed.
   grass → zebra → hyena/vulture
   c) The body will be decomposed by micro-organisms like bacteria.
   grass → zebra → hyena/vulture → bacteria
2. a) Locusts are herbivores. They eat plants.
   b) Bird
   c) plants → locusts → praying mantis → bird

3. Pigs eat plant material and humans eat the pig.
   plants → pigs → humans
4. Learners' example from their immediate environment should be credited.

ACTIVITY 5 Draw and label a simple food web

LB p. 54

Learners work on their own.

1. A food web is the way in which plants and animals are connected by their feeding relationships in an ecosystem.
2. Learners draw and label a simple food web.

PRACTICAL TASK – ACTIVITY 6 Research a local ecosystem as a case study

LB p. 55

Learners work in groups.
This Practical Task aims to take learners out of the classroom. They need to engage with their environment and be aware of what is going on around them. They must make clear decisions on selecting a plot; they must measure, observe, collect data, think out of the box and identify threats to their ecosystems. They need to suggest solutions on how to prevent or save their ecosystem and prepare a presentation to make their class aware of their findings. The task can be used as a formal assessment, but then learners must work alone or in pairs.
Use a rubric or memorandum to assess this task.

Example:

1. Selection of the ecosystem (1)
2. Correct dimensions of the ecosystem (1)
3. a) Three plants found in the ecosystem (1)
   b) Three animals found in the ecosystem (1)
4. Non-living things: Sun, water, soil, gases, mineral elements, wind, temperature, etc. Any three. (1)
5. ONE threat (1)
6. ONE good suggestion (1)
7. Presentation (poster and/or oral) (2)

Total [15]

How are you doing?

LB p. 55

Take this opportunity to ask learners if there is anything that they do not understand in the topic. You can check their understanding by asking them some questions about the information covered in the topic. Explain anything that learners do not understand.

Revision: Test

LB p. 56

1. a) Water, sunlight, carbon dioxide (3)
   b) Photosynthesis (1)
   c) Oxygen (1)
2. a) Energy (1)
   b) Meat, fish, eggs, milk, nuts, beans, etc. (Any 1) (1)
   c) Storing energy (1)
   d) Vitamins and minerals (1)
3. a) 1 Proteins
      2 Fruits and vegetables
      3 Carbohydrates
      4 Dairy products
      5 Fats and oils (5)
   b) Fruits and vegetables; Carbohydrates (2)
   c) Proteins; Dairy products; Fats and oils (3)
4. a) Water (2)
   b) Kwashiorkor, or any other appropriate example of a disease (1)
5. a) We process food to make it edible, make it last longer and to improve the nutritional value. (Any 2) (2)
   b) Cooking, drying and salting, pickling, combining (Any 2) (2)
   c) Processing food can contribute to food losing some of its nutrients, processed food often contains unhealthy additives. (Any 1) (1)
6. a) Air, water, sunlight, soil (learners must give one example, as well as a brief explanation of one of its functions, e.g. sunlight gives plants energy to produce their own food through photosynthesis) (2)
   b) A food web shows how plants and animals are connected in many different ways to help them all survive. A food chain follows just one path of energy as animals find food. (1)
   c) Producers, consumers, decomposers (3)
   d) Any food chain which follows logically and shows that the learners understand the concept. (2)
7. a) lime; milky (2)
   b) The air that we breathe out contains carbon dioxide. (1)
8. When we mix yeast with lukewarm water and place it in a warm place, the dormant yeast starts growing again. When we mix the yeast with flour to make bread, it makes little bubbles that allow the bread to rise. (2)
9. Learners' paragraphs should reflect suitable answers about the ecosystem that they chose, reflecting the ecosystems they learnt about in this topic.
   a) type of ecosystem correctly identified (1)
   b) location correctly described (1)
   c) appropriate description of climate and living conditions (2)
   d) correct identification of two plants found in ecosystem (2)
   e) correct identification of two animals found in ecosystem (2)
   f) learner's own opinion about why the ecosystem should be protected, appropriately expressed (2)

TOTAL: 50 MARKS

TERM 2

Natural Sciences: Matter and materials Technology: Processing

TERM 2
Natural Sciences: Matter and materials Technology: Processing

TOPIC 1: Solids, liquids and gases
Unit 1.1 Arrangement of particles

TOPIC 2: Mixtures
Unit 2.1 Mixtures of materials

TOPIC 3: Solutions as special mixtures
Unit 3.1 Solutions
Unit 3.2 Soluble substances
Unit 3.3 Saturated solutions
Unit 3.4 Insoluble substances

TOPIC 4: Dissolving
Unit 4.1 Rates of dissolving

TOPIC 5: Mixtures and water resources
Unit 5.1 Water pollution
Unit 5.2 Importance of wetlands

TOPIC 6: Processes to purify water
Unit 6.1 Clean water

Topic 1 Solids, liquids and gases

$1\frac{3}{4}$ hours

Curriculum content and concepts

Arrangement of particles

- All matter (solids, liquids and gases) is made up of particles
- The particles are arranged differently in solids, liquids and gases
  - in solids the particles are closely packed in a regular pattern – spaces between the particles are small and particles vibrate in one place
  - In liquids the particles are closely packed in no fixed pattern – spaces between the particles are small but particles can move around each other
  - in gases the particles are far apart from each other – spaces between the particles are big and particles move in all directions.

Unit 1.1 Arrangement of particles LB p. 59

Resources needed

- Diagrams to show particles in matter
- Video clips from the Internet

What do you already know? LB p. 59

This is a baseline assessment to determine learners' existing knowledge on matter.

Learners work with another learner.

1. Matter is everything on Earth. The whole universe consists of matter.
2. Solid, liquid and gas.
3. Solid – ice; liquid – water; gas – water vapour
4. Heat and cold
5. No, water vapour is not visible because the particles it consists of are too wide-spread to see.
6. Material
7. We cannot create or destroy matter. A scientist can only use existing matter to make another type of matter.
8. Yes, steam drives turbines that generate electricity. Food creates heat energy. Machines create movement energy and so on.
9. No

Teaching the lesson

Particles in solids **LB p. 59**

Explain the arrangement of particles in all three states of matter by drawing diagrams of them, discussing diagrams in the Learner's Book

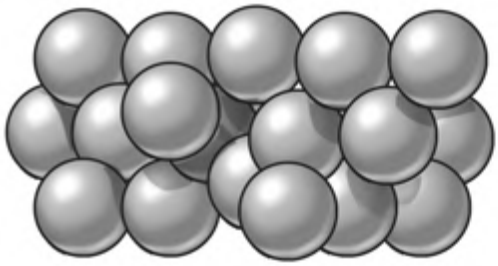
and by demonstrating with ice, water and steam. A handy method to explain this is by using marbles or coloured plastic balls in three different sized (small, medium and large) see-through plastic containers. The number of marbles in all three containers must be the same. The learners will see that the marbles in the 'liquid' and 'gas' container have more space to move in and will therefore spread out more.

ACTIVITY 1 Draw the arrangement of particles in solids, liquids and gases LB p. 60

Learners should be taught how a scientific drawing should look. Discuss and explain the content on page 61 and have them practise it by drawing something simple such as a pen or pencil. Teach them to draw a frame before commencing with the actual drawing. They should remember to leave sufficient space for the labels and connecting lines. Every drawing from here on should adhere to the rules stated on this page.

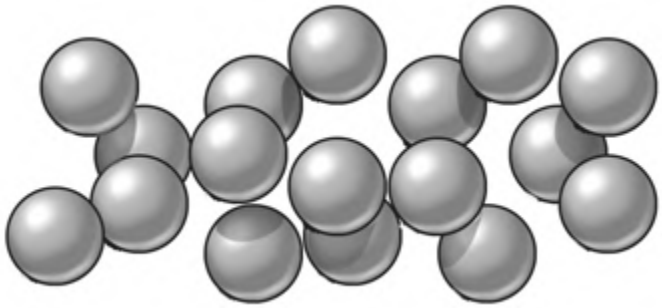
Their drawings should look like this:

a)



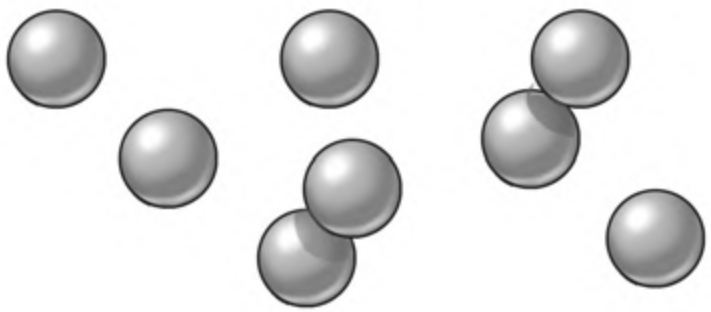
Particles in a solid

b)



Particles in a liquid

c)



Particles in a gas

The atoms in a solid have an ordered pattern, while the atoms in a liquid are randomly arranged. Atoms in a gas spread outwards and upwards.

Topic 2 Mixtures

$3\frac{1}{2}$ hours

Curriculum content and concepts

Mixtures of materials

- A mixture consists of at least two different substances/materials mixed together
- In some mixtures, the different substances are still clearly visible after mixing
- The substances in such mixtures can be separated by physical means such as sieving, filtering, hand sorting, settling and decanting

Unit 2.1 Mixtures of materials LB p. 62

Resources needed

- Examples of material such as salt, sand, sugar, tea leaves, peanuts, dried beans, coins, sweets, curry powder, grated cheese, milk, oil
- Video clips from the Internet

What do you already know? LB p. 62

1. A mixture is something that is produced by combining other things.
2. An example of a mixture is milk and chocolate powder to make a milkshake or tea (a combination of a tea bag, sugar, milk and hot water).

Teaching the lesson

Divide the learners in groups. Each group must have a leader who assigns tasks to the group members. Ensure that each learner has an opportunity to be leader throughout the course of the year.

Provide small containers such as paper cups, for each mixture. Ask learners to mark each cup with a Koki stating the ingredients of the mixture inside. Each learner should touch the ingredients before mixing. Learners should take turns to make one or more of the mixtures. They should record their observations in a table as requested on page 63 in the Learner's Book. On page 64, read and discuss the different methods of separation. Try to demonstrate each method if possible.

ACTIVITY 1 Observe mixtures LB p. 62

Learners work in groups to observe what happens when they mix a variety of things.

1. Learners examine and discuss each substance before mixing.
2. They predict what they think the mixtures will look like.
3. Learners mix the substances and test their predictions.
4. They record their observations in a table.

Topic 3

Solutions as special mixtures

$8\frac{3}{4}$ hours

Curriculum content and concepts

Solutions

- Solutions are also mixtures
- Some solutions can be made by mixing a solid and a liquids together such as sugar and water, salt and water
- Solutions are uniform in appearance and the solid cannot be seen after mixing.

Soluble substances

- Soluble solids (solutes) can dissolve in water (solvent)
- The substances in solutions cannot be separated by sieving, filtering, hand sorting, settling and decanting
- Some solutes can be recovered (separated) by evaporating the solvent (such as recovering salt from sea water)
- When substances dissolve, solute particles become dispersed in the spaces between the solvent particles.

Saturated solutions

- A solution is saturated when no more solute can dissolve in a given amount of solvent.

Insoluble substances

- Some solids will not form a solution in water (insoluble solids).

Unit 3.1 Solutions LB p. 65

Resources needed

- Basic science apparatus and materials for the various experiments in this topic, e.g. glass beakers, hot plate or Bunsen burner, turpentine (refer to the various activities for what you need)
- Examples of materials and substances such as salt, sugar, sand, mealie meal, flour, maize flour, samp, curry powder, custard powder
- Measuring cylinders, funnels, filter paper, beakers, evaporating dish, salt, food colouring

Teaching the lesson

Ensure that the learners understand the difference in meaning between a solute, solvent and solution and that they understand what the terms ‘soluble’ and ‘insoluble’ mean. They should be encouraged

to use the correct scientific terminology during the practical task. By repetition the terminology will become familiar to them. Should there be a shortage of scientific equipment at the school, try to improvise or ask the learners for ideas.

PRACTICAL TASK – ACTIVITY 1 Investigate different solids to see if they dissolve in water LB p. 65

Learners work with another learner.
Discuss the importance of fair testing in scientific investigations or experiments. Ensure that equal amounts of solvent and solutes are used during the investigation. Encourage learners to watch closely and to ask questions where needed. Remind them to take notes during the investigation as they will have to record their findings in a table later. Discuss the activity and questions beforehand so that they will know what to look out for. Learners should be taught how to predict and draw conclusions from every result.

ACTIVITY 2 Draw and describe solutions LB p. 66

Learners work on their own.
Remind learners to stir each solution for at least a minute to determine if the substance added to the water is indeed soluble or not. Their tables should reflect the same answers as the one below.
Remember: Learners have to choose only ten solutes for this investigation.

Solvent	Solute	Dissolved in water	Partly dissolved in water – some residue left	Did not dissolve in water
water	instant coffee	✓		
water	sand			✓
water	sugar	✓		
water	salt	✓		
water	mealie meal		✓	
water	jelly powder		✓	
water	flour		✓	
water	samp			✓
water	curry powder		✓	
water	custard powder	✓		
water	Maizena	✓		
water	cooldrink powder	✓		

Drawings should be done according to specifications – colour may be used.

Descriptions should include the components that were mixed and the process of stirring. The conclusion would either be that the substance is soluble, partly soluble or insoluble depending on the result of each example they chose.

Unit 3.2 Soluble substances LB p. 67

Resources needed

- Basic science apparatus and materials for the various experiments in this topic, e.g. glass beakers, hot plate or Bunsen burner, turpentine. Refer to the various activities for what you need.

Teaching the lesson

Explain the purpose of separating solutes from solvents by using the example of salt production and copper sulphate.

ACTIVITY 3 Investigate solutions to see if we can recover the solute LB p. 68

Learners work in groups.

For Parts 1 and 2: discuss the purpose of the investigation. Ask learners to predict the outcome. Read the information on fair tests on page 71 with learners and ask learners to determine if the investigation in Activity 3 meets the requirements of a fair test. Ask the learners what the main difference between this investigation and the one in Activity 1 is. The difference is, in Activity 1 cold water was used, and in this activity hot water is being used.

The amount of salt added will depend on the size of the glass jar being used. Add about two tablespoons of salt to 250 ml hot water. The three methods used to separate become apparent in Part 2 of the investigation.

1) Settling 2) Filtering 3) Evaporation

Part 3: Learners record their findings in a table in their exercise books and then compare them. The conclusion should be that salt can be separated from a saltwater solution by evaporation only. Unless the solutions were overly saturated, no crystals should be left when the solution has settled or has been filtered. Learners write what they have learnt from the investigation.

ACTIVITY 4 Investigate evaporation with copper sulphate LB p. 69

Learners work in groups.

Ensure that learners keep a safe distance from open flames. Follow the method as set out on page 70. Ask learners to clarify what is being investigated and what they predict the outcome will be. Learners answer question 5 in their exercise books while they wait for the solutions to filter. After the filtration process has completed, learners must answer Questions 11 and 12 in their exercise books as well. Ask the learners to make notes about the fairness of the test. They should also determine if their prediction and the final results correlate.

Unit 3.3 Saturated solutions LB p. 71

Resources needed

- glass beakers
- hot water
- sugar

Teaching the lesson

Learners should be clear about the difference between a saturated solution and insoluble substances.

Explain that some residue of the solute will be visible in a saturated solution. It shows that the solvent has reached its capacity and no more solute will dissolve in the solution.

Demonstrate the saturation point of water by adding sugar to a glass beaker filled with hot water. At some point the sugar will not dissolve any more and will settle at the bottom of the glass.

Unit 3.4 Insoluble substances LB p. 72

Resources needed

- Basic science apparatus and materials for the various experiments in this topic: bottom half of a plastic 2ℓ bottle, two glass beakers, soil, oil paint, turpentine, candle and methylated spirits. If possible, water-based craft paint can be dissolved in water as a comparative test.

Teaching the lesson

You should perform this investigation while learners observe. Learners should not touch or handle any apparatus. Ask learners to record what they see while the solutions are made. They should draw conclusions to answer the questions in Activity 5.

ACTIVITY 5 **Observe the dissolving of oil paint and wax** **LB p. 74**

You will do this demonstration.

Follow the method given on page 74 while learners observe.

Topic 4

Dissolving

$3\frac{1}{2}$ hours

Curriculum content and concepts

Rates of dissolving

Factors that affect the rate (time taken) of dissolving:

- Temperature of the mixture
- Stirring or shaking the mixture
- Grain size of the solute

Unit 4.1 Rates of dissolving

LB p. 75

What do you already know?

LB p. 75

Learners work on their own.

1. Learners explain what dissolving means.

Learners work in groups.

2. The temperature of the mixture, stirring or shaking the mixture and the grain size of the solute.

Resources needed

- Containers, beakers, ice-cream sticks for stirring, measuring spoons, hot water, salt (coarse and fine)

Teaching the lesson

Discuss the three factors that influence the rate of dissolving. Refer to the photographs on page 75 of the Learner's Book. Draw a diagram on the board showing the following:

- sugar + water + heat = faster rate of dissolving
- sugar + hot water + stirring or shaking = faster rate of dissolving
- milk + chocolate powder + shaking = faster rate of dissolving
- oil + vinegar + shaking = will mix for a short time and then separate again

We say that oil and vinegar or oil and water are immiscible (not able to stay mixed).

ACTIVITY 1 Observe the dissolving of substances LB p. 76

Learners work in groups, under supervision.
Make sure you have all the necessary equipment and other things necessary for the activity. Prepare learners for the activity by going through the activity with them beforehand. You will need to assist learners with the various steps involved in the activity. Learners must follow the instructions carefully. They must also record their answers to the questions in the Learner's Book in their exercise books.

ACTIVITY 2 Consider how heating affects dissolving LB p. 77

Learners work with another learner to discuss the picture story in the Learner's Book.

1. a) The boy and girl wanted to make their mother coffee on Mother's Day. When the boy poured the water into the cup, the coffee did not dissolve. This is because he did not add hot water to the coffee granules.
   b) Heat helps substances to dissolve.
2. Learners should be able to identify that substances (e.g. coffee powder) dissolve better in hot water.

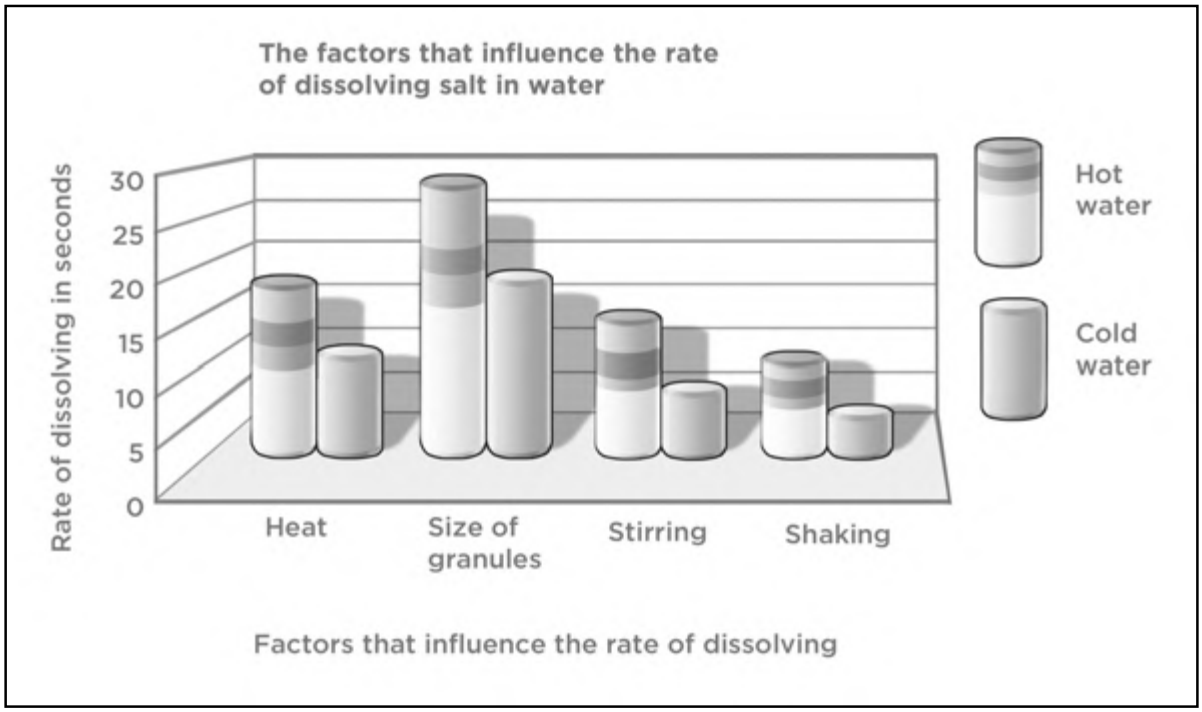
PRACTICAL TASK – ACTIVITY 3 Conduct a fair test about factors that influence the rate of dissolving LB p. 78

Learners work with another learner with guidance from the teacher.
Guide the learners by reading Activity 3 with them.
Learners should write down:

1. What do they hope to accomplish by doing the investigation?
2. What do they want to find out?
3. What do they predict will happen?
4. What do they need to do the investigation?
5. How will they ensure that it is a fair test?
6. How will they go about conducting the investigation? Guide learners to choose a solvent, solute and method of heating.
   Fine salt and coarse salt can be used. Or you can give them a copy of the guidelines provided on page C10 of the Teacher's Guide.

Explain the examples of a bar and pie graph on pages 79 and 80. Guide them to choose a graph to illustrate their findings. It should have a heading: FACTORS THAT INFLUENCE THE RATE OF DISSOLVING OF SALT IN WATER. The x-axis should be labelled: Rate of dissolving in seconds. The y-axis should be labelled: Factors influencing rate of dissolving. Use the graph on the next page as an example but allow variations from learners as long as data is correctly illustrated.

Learners must write about the conclusions they have reached after examining their findings.



How are you doing? **LB p. 80**

Take this opportunity to ask learners if there is anything that they do not understand in the topic. You can check their understanding by asking them some questions about the information covered in the topic. Explain anything that learners do not understand.

Topic 5

Mixtures and water resources

8¾ hours

Curriculum content and concepts

Water pollution

In the environment, many things mix or dissolve in water. Water can be polluted by:

- Insoluble substances, such as oil, plastics, tyres, tins, glass, toilet waste
- Soluble substances, such as soaps, fertilisers, insecticides, acids and other poisons
- Living germs from toilet waste causing water-borne illnesses such as diarrhoea.

Importance of wetlands

Natural wetlands are important for:

- Removing soluble and insoluble substances from water
- Acting like sponges and regulating the flow of water.

Unit 5.1 Water pollution

LB p. 81

Resources needed

- Texts for reading about water pollution
- Video clips from the Internet

What do you already know?

LB p. 81

This is a baseline assessment to determine learners' existing knowledge on water pollution.

Learners work with another learner.

1. Rivers, lakes, dams, springs, groundwater
2. They are sustained by precipitation.
3. Oil, plastics, tyres, tins, glass, toilet waste, medical waste, ropes
4. Soaps, fertilisers, insecticides, acids, chemicals from manufacturing processes, poisons
5. Cholera, typhoid fever, e-coli, diptheria
6. Learners' answers will vary.

Teaching the lesson

Discuss and explain the importance of water for living things. Our fresh water resources make up only 1% of all water on Earth. Focus on the importance of preserving our natural and manufactured water resources to ensure sustained life on the planet. One of the disadvantages of new technology is the pollution of our water resources with manufactured substances and material.

ACTIVITY 1 Answer questions on water pollution

LB p. 82

Learners work on their own to answer the questions about the pictures in the Learner's Book.

1. a) oil, plastic, glass, tyres
   b) chemicals, poisons
2. a) 8
   b) They are playing in the overflow water from a drain.
   c) No, it is not safe as the water may contain human faeces.
   d) Washing powder or soap, urine, dirt in clothes.
   e) Yes, water containers are being filled.

Unit 5.2 Importance of wetlands

LB p. 83

Resources needed

- The Learner's Book provides an example of a wetland area in South Africa, but it would be good if you could supplement this with information about wetlands in your own area. Unless you live in a very dry part of the country, there should be at least a small wetland close to you. In many areas there are wetlands with well-developed information centres that also provide educational tours for learners.
- If at all possible, try to take your class on an excursion to a wetland when you are covering this topic with them. Most of these wetlands also have their own websites with an educational focus which give detailed information and often supplementary activities that can be used for extension work.

Teaching the lesson

Discuss the importance of wetlands as set out in text on pages 83 to 84. Ask the learners about wetlands and if there are some located near them. Do the case study by dividing the learners into groups to read and discuss the content of page 85 and the top of page 86.

ACTIVITY 2 Research and write a report about a wetland LB p. 86

Learners work with another learner.
Explain how to write a report by discussing the skills box on page 87 with learners. If possible, arrange a visit to a local wetland or ask someone to come and talk to the learners about it. Assist learners with research by sourcing books and other resources with information about wetlands. Learners must plan first by making a mind map of what they hope to find out about the wetland, where they will get information and how to go about processing the information they have.

Learners should first write a rough draft, present it to the teacher for comment, and then refine and rewrite the final report. This should be done in class and not at home.

Take the learners' reports and assess them according to the rubric below.

Criteria	Level 1	Level 2	Level 3	Level 4	Level 5
The learner planned the report.					
The report had a clear structure.					
The learner drafted the report and made improvements.					
The learner completed the final report with all the necessary criteria.					

Key to levels

Level 1	Learner made no attempt to meet the criteria.
Level 2	Learner attempted the criteria but was unable to complete it successfully.
Level 3	Learner managed an acceptable level of completion of the criteria.
Level 4	Learner understood the requirements and completed the criteria successfully and correctly.
Level 5	Learner showed exceptional knowledge and skill in the correct completion of the criteria.

Topic 6

Processes to purify water

8¾ hours

Curriculum content and concepts

Clean water

- A clean supply of water is important for people, plants and animals
- Water can be cleaned by processes such as sieving, filtering, settling, decanting, boiling and adding chemicals to kill germs
- Municipal water is cleaned before and after we use it.

Unit 6.1 Clean water LB p. 88

Resources needed

- Sieves, filter paper, funnels, containers, kettle, water purification tablets (if possible)

Teaching the lesson

Discuss pages 88 to 90 with learners. Ask questions about their fresh water availability and resources. Make them aware of other South Africans that may be less fortunate than them. Discuss the different methods of cleaning water and why it is necessary to drink only clean, safe water.

Alternative methods of obtaining clean drinking water include desalinated sea water and purifying/recycling sewage water. Refer to the drawing on page 90. Ask learners how they feel about these options. Introduce Activity 1 by asking learners how many of them have had to purify drinking water and why.

ACTIVITY 1 Investigate how to best purify dirty water LB p. 91

Learners work in groups.

Sometimes we do not have the luxury of sophisticated purifying systems but do need to purify our drinking water. Guide and assist the groups of learners through the activity. Discuss the why and how of what is being done throughout the activity. Refer learners to information about earlier methods of purifying water resources by ancient cultures that is contained in the fact sheet overleaf.

Ancient cultures' water purification systems – fact sheet

Time frame

- There is evidence of water purification methods dating back to 4000 BC. Improvements made included taste and how the water looked, though some types of bacteria were not removed by those methods. Between 4000 BC and 1000 AD, different natural minerals were used to purify water. Distillation also began to be used.

Material used

- To disinfect water, many ancient cultures would use copper, iron or hot sand in conjunction with boiling the water. Herbs such as amla, which is high in vitamin C, and khus, were often used in well filtration. Plants, such as water lily roots and the seeds of the nirmali (*Strychnos potatorum*) were sometimes used to purify water.

  In ancient Egypt, aluminum sulfate, iron sulfate or a mix of the two was used to extract suspended solids from the water. In Greece a fabric bag, called the Hippocrates' Sleeve, was used to strain water before boiling it. In ancient India, sand and gravel were used to filter water before boiling it. This method was found in the Sanskrit manuscript called the Susruta Samhita.

How water was judged

- Ancient civilisations did not know about tasteless toxins that could grow in water. Their main way of testing water purity was through its clearness, taste and odor.

Storage

- Certain metals, including copper disrupt bacteria cycles. In ancient India brass, an alloy of copper and zinc and sometimes other metals, was used to store water. The ancient Greeks and Romans used basins or reservoirs to store water and as a means to let particles settle.

Considerations

- The Romans, Greeks and Mayans all used aquaducts to keep water pure. When these cultures collapsed, water purification advancements were halted. Hundreds of years later, in 1627, Sir Francis Bacon began to experiment with salt water purification. He tried to remove salt from water using sand, and though he failed, he helped to restart interest in water filtration.

Read more: Ancient Water Purification Methods | eHow.com http://www.ehow.com/about_4794725_ancient-water-purification-methods.html#ixzz2DETjJkll

Learners work on their own.
Read and discuss the water purification systems with learners. Learners should understand that these are basic systems that will get rid of impurities but not harmful bacteria and germs. These systems should be used together with a chemical such as bleach to kill bacteria.

PROJECT – ACTIVITY 2 Design, make and evaluate a simple system to clean dirty water LB p. 92

Discuss the problem and questions on page 93 with learners. Explain what is expected of them and how they should go about gathering information for this task. Learners are expected to follow the technological process in completing this task. They should:

- investigate existing products or systems
- do research on alternative methods suitable to the scenario presented in the problem
- write a design brief with specifications and constraints
- design possible solutions and choose one
- write the order of work in sequence
- make the filter
- test the filter according to the specifications
- evaluate the success of the filter and suggest ways to improve on the original design by making minor adjustments.

Assess learners' projects according to the following rubric:

Criteria	Level 1	Level 2	Level 3	Level 4	Level 5
Learners investigated existing products or systems.					
Learners did research on alternative methods suitable to the scenario presented in the problem.					
Learners constructed a design brief with specifications and constraints.					
Learners designed possible solutions and chose one.					
Learners wrote the order of work in sequence.					
Learners made the filter.					
Learners tested the filter according to the specifications.					
Learners wrote an evaluation report on the success of the filter and suggested ways to improve the original design and made minor adjustments.					
Learners worked together as a team.					

(Refer to the Key to levels on page B36.)

Revision: Test

LB p. 94

Section A: Life and living

1. a) Photosynthesis, sunlight, carbon dioxide, water, glucose sugar, oxygen (6)
   b) The resulting energy is stored in the leaves, stem, fruit and roots of the plant, in the form of starch (chemical energy). (2)
   c) People and animals get their energy from the food they eat. They eat plants or products made from plants, or they eat meat from other animals that have eaten plants. (2)
2. a) Carbohydrates: pasta, sugar, potatoes, lentils
   Proteins: lentils, fish, eggs, milk, nuts
   Fats and oils: butter, nuts
   Vitamins and minerals: lentils, oranges, spinach (5)
   b) Learners should be able to indicate what our bodies use the different food groups for, as explained in the table in the Learner's Book page 16. (5)
3. a) A balanced diet contains food from all the nutrient groups, as well as water and fibre. (2)
   b) To provide our bodies with enough nutrients for energy and growth; but eating too much of certain food groups (especially fats and oils) can lead to us becoming overweight, and this in turn can affect our health negatively. (2)
4. a) Carbohydrates, such as bread and pasta, for energy (2)
   b) Food that is easy to digest (they do not have teeth yet to chew food): food that is high in nutrients to ensure healthy growth. (2)
5. a) It helps food move smoothly through the body. (2)
   b) Dried fruits, such as raisins or apricots – accept any other appropriate examples (1)
6. Learners draw a labelled diagram of a food web that they might find in a savanna. Learners include at least two animals in their food web. The animals must belong to the savanna and should be labelled as producer, consumer or decomposer. (5)
7. a) It is easier to prepare, found at any time of the year, can be kept for a longer period of time and sometimes extra nutrition is added. (2)

b) Butter (not margarine), yoghurt, *Maas*, cheese, buttermilk, ice-cream, or any other correct answer (2)

Total Section A: 40 marks

Section B: Matter and materials

1. a) Learners' drawings should reflect the diagrams on page 59–60 of the Learner's Book, with descriptions as below.
In solids, the particles are packed together in a regular pattern. The spaces between the particles are small and the particles vibrate in one place.
In liquids the particles are closely packed in no fixed pattern. The spaces between the particles are small but the particles can still move around each other.
In gases the particles are far apart from each other. The spaces between the particles are big and the particles move in all directions. (6)
2. a) Hand sorting, sieving, filtering, settling, decanting, magnetised extraction (Any 2)
   b) The magnet will attract the iron filings, but not the sand. Magnetised extraction (2)
3. a) A solution is a mixture in which a substance is dissolved in another substance. Solutions are uniform in appearance. In a solution of a liquid and a solid, the solid cannot be seen after mixing. (Any 2)
   b) The salt is the solute and the water is the solvent. (2)
   c) Soluble (1)
   d) Evaporation (1)
   e) A saturated solution is a solution in which the maximum amount of solute has been dissolved into the solvent. (1)
   f) The temperature of the mixture, stirring or shaking the mixture, the grain size of the solute (3)
4. a) Soluble substances can dissolve in water; insoluble substances cannot dissolve in water. (Any 1 of each = 2)
   b) Soluble substances: soaps, fertilisers, insecticides, acids; insoluble substances: oil, plastic, tyres, tins, glass, toilet waste (2)
5. a) Any suitable example, e.g. cholera (1)
   b) Filtering or sieving (2)
   c) Add 5 ml of bleach to 25 litres of cooled-down boiled water. Let it stand for an hour before drinking. (2)
6. a) Wetlands are permanently waterlogged areas like swamps and marshes. They are important freshwater ecosystems. (2)
   b) Wetlands act like sponges to preserve and regulate the flow of water. They make sure that not all fresh water runs off to the ocean. Wetlands preserve and sustain a wide variety of plants and animals. Wetlands act as filters by purifying water as it drains through the soil to the groundwater table. Wetland vegetation has the ability to remove pollutants and dangerous chemicals from water. (4)

Total Section B: 35 marks

TOTAL: 75 MARKS

TERM 3

Natural Sciences: Energy and change Technology: Systems and control

TERM 3
Natural Sciences: Energy and change Technology: Systems and control

TOPIC 1: Electric circuits
Unit 1.1 A simple circuit
Unit 1.2 Circuit diagrams

TOPIC 2: Electrical conductors and insulators
Unit 2.1 Conductors
Unit 2.2 Insulators

TOPIC 3: Systems to solve problems
Unit 3.1 Using electric circuits

TOPIC 4: Mains electricity
Unit 4.1 Fossil fuels and electricity
Unit 4.2 Cost of electricity
Unit 4.3 Illegal connections
Unit 4.4 Renewable ways to generate electricity

Topic 1 Electric circuits

8 3/4 hours

Curriculum content and concepts

A simple circuit

- An electric circuit is a system for transferring energy
- A simple circuit always has the following components:
  - source of energy (such as cell)
  - conducting material (such as wires)
  - device (such as light bulb, buzzers, motors) for changing electricity into a useful output energy
- A circuit is a complete, unbroken pathway for electricity
- A switch can be added to break or complete the circuit pathway.

Unit 1.1 A simple circuit LB p. 97

Resources needed

- Cells, bulbs, insulated wires, switches, diagrams

What do you already know? LB p. 97

This is a baseline assessment to determine learners' existing knowledge on energy. Learners work as a class.

1. Energy is the ability to do work.
2. Children playing in the park, person pushing a pram, car hooting, car driving, boy riding a bicycle, sunlight from the Sun, wind, electric power lines.
3. The car driving and the electric power lines are non-renewable sources of energy.
4. Learners list examples of kinetic and potential energy and give reasons for their answers.
5. Light – Sun shining
   Heat – Sun
   Sound – radio in car
6. All need some kind of energy.

Teaching the lesson

Electrical charge LB p. 98

Discuss the content on page 98 in the Learner's Book. Show learners a cell. Point out the + on the one side which is the positive side, and the – on the other side, which is the negative side. Explain key words to learners.

Electrical current LB p. 98

Discuss the content on page 98 in Learner's Book. Explain key words to learners.

Electric circuit components LB p. 98

Bring different examples of light bulbs and cells to school. Discuss each component separately with the learners.

Remember that the plastic covering of the electrical wire must be removed for about 2 cm to expose the wire. If this is not done, the connection will not be effective. Show learners how to do this.

Show different switches to the learners. Explain the reason for using switches as on page 101 in Learner's Book.

Connecting more than one cell LB p. 99

Be sensitive, as some of the learners might not have electricity at home. Don't assume that all learners know about electricity. Discuss the content on page 99 in the Learner's Book.

ACTIVITY 1 Demonstrate electrical current in an electrical circuit LB p. 99

Learners work as a class.

Bring a working radio or torch with cells to school. As a class, discuss the diagram on page 99. Talk about the connection of cells in a radio or torch. Change the way in which the cells should be connected and show learners that the radio or torch will not work if cells are connected incorrectly.

1. So that the current can flow in one direction through all the cells.
2. An appliance shows which way batteries must be inserted.
3. The appliance would not work.

Electrical wires and light bulbs LB p. 100

Explain to the learners what the purpose of electrical wires are and why the ends must be stripped to connect a circuit. Also explain what the purpose of light bulbs are and discuss the different types available.

ACTIVITY 2 Design and make a switch LB p. 101

Learners work in groups.

Use the copper wires and give learners a METAL paper clip and two thumb tacks or paper fasteners. Learners connect the wires in a circuit and make a switch with the components that you have given them. Remember that the plastic covering must be removed where it touches the metal to make a good connection.

To make sure that the switch works, you must add the light bulb to the other components to see if it lights up. This will mean that the current flows when the switch is closed.

Unit 1.2 Circuit diagrams LB p. 102

Resources needed

- Learner's Book pages 102 and 103 with diagrams to refer to.

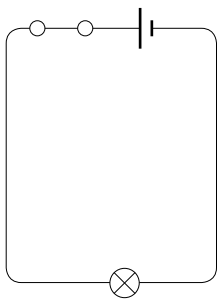
Teaching the lesson

- Show learners the symbols for drawing an electrical circuit once they have done Activity 3.
- Discuss and explain the various symbols to use when drawing a circuit diagram.
- Point out that these symbols are internationally recognised, just like road symbols, and that they cannot draw their own version of the symbol.

ACTIVITY 3 Match electrical symbols to electric circuit components LB p. 102

Learners work with another learner.

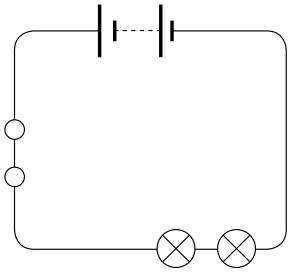
1. a) cell
   b) wire
   c) switch
   d) bulb
   e) battery
2. Discuss the correct answers in class so that learners can see if their predictions were correct.
3. Learners redraw the circuit using international symbols. Their diagram should look like the one below.



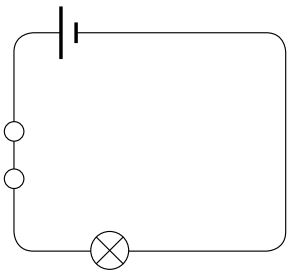
ACTIVITY 4 Draw circuit diagrams LB p. 103

1.

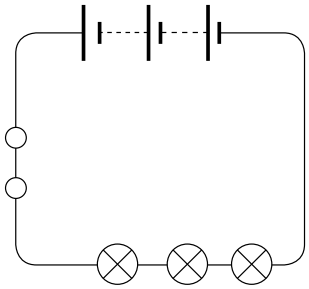
a)



b)



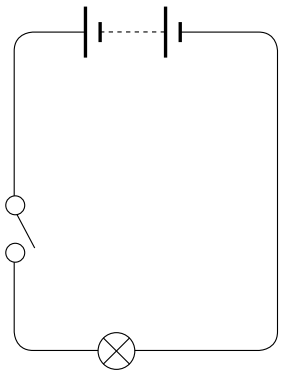
c)



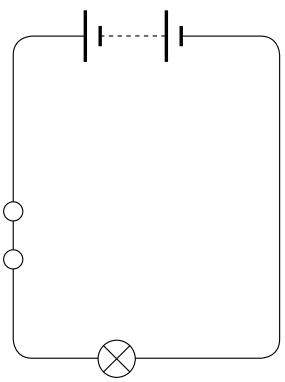
ACTIVITY 5 Draw circuit diagrams of open and closed circuits LB p. 103

Learners work on their own.

1.



2.



Topic 2 Electrical conductors and insulators

7 hours

Curriculum content and concepts

Conductors

- Some materials conduct electricity and are called conductors
- Most metals, especially copper, conduct electricity

Insulators

- Some materials do not conduct electricity and are called insulators
- Most non-metals, such as plastics, do not conduct electricity

Resources needed

- Cells, bulbs, insulated wires, switches
- Conductors: coins, paper clips, pieces of wire, metal utensils, etc.
- Insulators: plastic, cardboard, wood, rubber objects

What do you already know? LB p. 104

Learners work as a class.

This activity is a baseline assessment to determine the learner's existing knowledge about conductors and insulators. Discuss the questions with the learners, engaging all the learners by letting them take turns to answer.

1. The copper wire
2. It functions as an insulator.
3. No, it won't because the plastic coating will prevent the current from flowing.

Unit 2.1 Conductors LB p. 104

Teaching the lesson

- Introduce the content to the learners by reminding them of the basic electrical circuit they built earlier.
- Explain that electrical current would not have been able to reach the light bulb from the battery, if it wasn't for the copper wire.
- Explain that some materials are good conductors of electricity and heat and others are poor conductors, called insulators.
- Show them the electrical cords in the classroom, for example that of the overhead projector, as well as the plug attached to the end of the cord. The cord is covered with a rubbery plastic and the plug has a rubber or plastic casing with three or two brass pins. They should know by now that metal (especially copper) is a good conductor of electricity, but humans are also good conductors of electricity. Therefore we have to cover electrical conductors with an

insulation material to prevent the current from entering our bodies.
- Ask them to imagine how much more powerful residential electricity of 220-240V is in comparison to the 1,5V bulb or cell we are using.
- Tell them that to find out about the conductivity potential of a material we have to build a conductivity tester.

PRACTICAL TASK – ACTIVITY 1 **Build a conductivity tester** **LB p. 105**

Learners work in small groups.
- Discuss with and refer the learners to the investigative process shown on page 23 of the Learner's Book while doing this task.
- Learners work in groups of 3 to 4.
- They collect all the equipment needed for this task.
- Explain what they are going to build and how they should go about it.
- The test will show conductivity if the light bulb lights up.
- Learners will be able to build the circuit board in one to two periods.
- Read carefully through the instructions on page 105 in the Learner's Book. Learners follow the process step by step.
- Learners that can do it quickly can assist other groups that are slower.
- Make sure that the simple circuit works before you can test for insulators and conductors.

Unit 2.2 Insulators LB p. 106

Resources needed
- Different materials including plastic insulated wires, rubber gloves used by electricians, glass and ceramic
- The conductivity tester built in Activity 1.

Teaching the lesson

Insulation LB p. 106
Discuss content in Learner's Book pages 106 and 107.

ACTIVITY 2 **Investigate the conductivity of different materials** **LB p. 107**

- Learners remain in the same groups as for Activity 1.
- Warn them prior to these activities to collect all the objects in the table on page 107 of the Learner's Book.
- Give each group a copy of the worksheet on page C13 of this Teacher's Guide.
- Learners commence testing the objects using the conductivity tester they built and complete the worksheet.

Answers

2.

Object	Conductor	Insulator
Metal spoon	X	
5 cent piece	X	
R1 coin	X	
Pencil		X
Metal paper clip	X	
Plastic paper clip		X
Cardboard		X
Eraser		X
Plastic spoon		X
Plastic ruler		X
Piece of wire	X	
Book		X
Aluminium foil	X	
Drinking straw		X

4. a) The conclusion should be that all the metal objects made good conductors while plastic, wood and paper are poor conductors and are thus insulators.
   b) The learners' table should look like this:

Conductors	Insulators
Metal spoon	Pencil
5 cent piece	Plastic paper clip
R1 coin	Cardboard
Metal paper clip	Eraser
Piece of wire	Plastic spoon
Aluminium foil	Plastic ruler
	Book
	Drinking straw

ACTIVITY 3 Identify where insulators are used

LB p. 108

Learners work on their own.

1. An insulator is something that does not allow electricity to flow through it or does not light up the bulb.
2. Plastic around wires, rubber gloves, glass or ceramic insulators on power lines.

How are you doing? LB p. 108

Take this opportunity to ask learners if there is anything that they do not understand in the topic. You can check their understanding by giving them some questions about the information covered in the topic in a worksheet that they answer on their own. Discuss the answers and learners can check the answers. Explain anything that learners do not understand.

Topic 3 Systems to solve problems

$8\frac{1}{4}$ hours

Curriculum content and concepts

Using electric circuits

- Electric circuits are often used to solve problems that require energy, such as street lighting, alarms, electric gates, traffic lights, fans and heaters.
- Electric circuits can also be used in models and toys.

Unit 3.1 Using electric circuits LB p. 109

Resources needed

- Drawings, posters, real examples of circuits
- Cells, bulbs, insulated wires, switches, buzzers, bells

Teaching the lesson

As reading and writing is very important in all subjects in the CAPS document, we need to include it as far as possible in this subject. Learners must know that spelling and sentence construction will also be assessed in this activity.

ACTIVITY 1 Think about a world without electricity LB p. 109

Learners work on their own.

1. Learners write a short paragraph on what the world would be like without electricity.
2. They write down three ways in which their life would be most affected by having electricity.

Learners work as a class.

3. Learners discuss the possible advantages of not having electricity.

Learners work in groups.

4. Learners discuss and compare the advantages and disadvantages of not having electricity.
5. Learners' answers will vary.

ACTIVITY 2 Complete a worksheet on energy transfer in systems LB p. 110

Learners work with a partner to discuss and complete the table.

Object	Input: Energy from...	Output: Energy changed to...
	Cells or battery electricity	Light
	Mains electricity	Heat
	Mains electricity	Drawing and sound
	Battery	Sound and drawings
	Coal	Heat
	Battery or mains electricity	Sound

You can provide them with a photocopy of the table that appears on page C14.

PRACTICAL TASK – ACTIVITY 3 Design and make a simple alarm system LB p. 112

Learners work in groups.

- The learners work in groups.
- In Grade 4 and 5 the learners were introduced to the technology process.

STEP 1:

- Refresh the learners' understanding of the technology process.
- The different activities in the process are:
  - Investigate
  - Design
  - Make
  - Evaluate
  - Communicate
- Refer learners to the diagram on the technology process on page 111 of the Learner's Book.

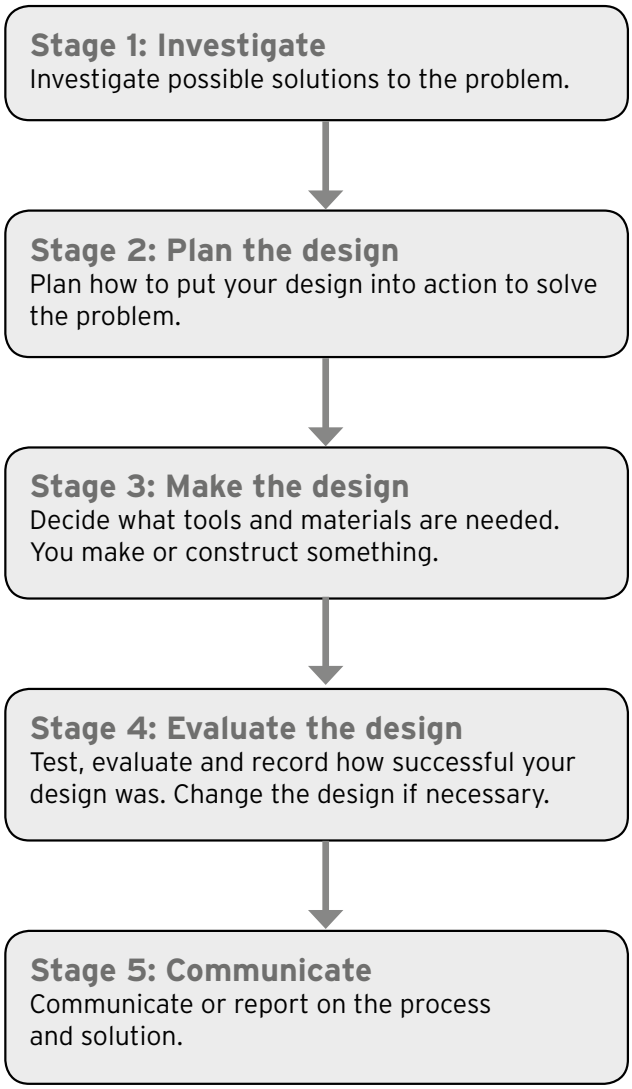
- Discuss the problem scenario with the learners.
- The learners are going to use the technology process to solve the problem as set out in the scenario on page 122 of the Learner's Book.
- You can photocopy and give them the Information sheet on 'Understanding the activities of the technology process' to guide them through the task. You will find this on pages C15–C18.

Background knowledge on the technology process:

The technology process

Before a product can be manufactured the designer has to do many different activities to design the product. These activities form the **technology process**. The activities most commonly used in the technology process are: investigate, design, make, evaluate and communicate. These activities can be done in any order, but every activity needs to be evaluated against the identified problem that has to be solved to satisfy a specific need or want.

The design process is not linear, but interactive. Often it is driven by evaluation. Evaluation at each stage determines the next step.



STEP 2: Investigate alarm systems to see how it works
- Read and discuss the relevant content on pages 113 and 114 with the learners.
- Make sure that they know the different parts of an alarm system and the function of each part.

STEP 3: Design
- Learners follow the steps of design as laid out on page 115 of the Learner's Book.

STEP 4: Make
- Use 3 weeks to complete the practical task.
- It is important that the practical task must be done in the classroom for you to assess the skills and knowledge of the learners.
- All work must be recorded in the learners' exercise books. It will form part of their project portfolio.
- You can use the analytical rubric in Section C of this book on page C6 to assess the learners.
- Give the learners a copy of the rubric before they start the task so that they know how they will be assessed.

- This task can be overwhelming for the learner, therefore they will need to be systematically lead through the 3 weeks of theory on the practical task.
  - Preparing learners for the task – about 3 lessons
  - Investigation – already done in Term 1
  - Design – about 4 lessons
  - Make – about 10 lessons
  - Evaluate – about 2 lessons
  - Communicate – about 2 lessons
- Don't cramp the creativity of the learner, but assist where needed.
- Safety is very important and learners need to be made aware of the dangers of the tools they will use.
- Do not allow the learners to work with the tools if you are not in the classroom.
- Make posters highlighting safety aspects and put them up in the classroom.
- The last week must be spent on finalising the practical task, evaluation and communication.
- Give learners the checklist for self assessment for the Practical Task, which appears on page C4 in Section C, to complete.
- Give learners the checklist for group activity for the Practical Task, which appears in Section C on page C5.
- Ask the various groups to show their products to the class and discuss the decisions they have made to solve the problem set out in the problem scenario.

How are you doing? **LB p. 115**

Take this opportunity to ask learners if there is anything that they do not understand in the topic. You can check their understanding by asking them some questions about the information covered in the topic. Explain anything that learners do not understand.

Topic 4

Mains electricity

$10\frac{1}{2}$ hours

Curriculum content and concepts

Fossil fuels and electricity

- Fossil fuels were formed in the Earth's crust millions of years ago from dead plants and animals
- Coal, oil and natural gas are fossil fuels
- In South Africa coal is mostly used as a fuel in power stations
- Coal was formed from fossilised plants which got their energy from the Sun originally
- In a power station coal is used to boil water, the steam turns the turbine which turns a generator, which produces electricity
- Fossil fuels are non-renewable resources.

Cost of electricity

Electricity is costly because:

- It requires infrastructure including coal mines, transport, power stations, pylons, substations, wiring
- Some electrical appliances require more electricity than others (heating appliances use the most)
- The more electricity we use the more we pay and the more coal is used up
- We can save energy in many ways including using energy-saving light bulbs and solar water heaters.

Illegal connections

- Illegal electrical connections are a danger to people because they are often unsafe
- Renewable ways to generate electricity
- People are looking for renewable ways to generate electricity.

Unit 4.1 Fossil fuels and electricity LB p. 116

Resources needed

- Drawings and video clips of fuels and their various uses
- Drawings to show how electricity is generated in a coal-fired power station
- Examples of electrical appliances

Teaching the lesson

What are fossil fuels? LB p. 116

Go through the explanation of fossil fuels in the Learner's Book. Use the diagram to assist you. Make sure learners understand the information.

ACTIVITY 1 Answer questions on fossil fuels LB p. 118

Learners work on their own.

1. Coal, oil and natural gas
2. 300 to 400 million years ago
3. Learners explain what sedimentation is.
4. Heat and pressure
5. Plants on Earth used the energy from the Sun for photosynthesis and to grow. This energy was stored in leaves, flowers and stems of plants. When the plants died the energy was trapped.
6. Learners draw a diagram to explain the formation of coal. Their diagrams should contain the three main stages outlined in the text.

ACTIVITY 2 Research where fossil fuels are found LB p. 119

1. Learners research which countries have large oil, coal and natural gas reserves.
2. They then research the three countries that use the most fossil fuels. Discuss their findings as a class.

Fossil fuels and electricity LB p. 119

Go through the content in the Learner's Book with learners. Make sure they understand it.

ACTIVITY 3 Make a poster to trace the source of the electricity you use at home LB p. 121

Make sure learners have all the necessary equipment. Go through the instructions in the Learner's Book and give them guidance where necessary. Display their posters in class.

Learners who do not have electricity at home may need extra guidance, but should still be able to explain the process of how electricity reaches homes, businesses, etc.

Fossil fuels are a non-renewable source of energy LB p. 121

Make sure learners understand what 'non-renewable' means. Go through the content in the Learner's Book with the learners.

Unit 4.2 Cost of electricity LB p. 122

Teaching the lesson

Why is electricity expensive? LB p. 122

As a class, discuss the possible reasons for electricity being expensive. Learners should link the cost of producing electricity to the fact that it is expensive.

Read and discuss the information provided on this page in the Learner's Book.

ACTIVITY 4 Find out the amount of energy required by electrical appliances and devices LB p. 123

Learners work on their own.

This activity will depend entirely on learners' input. Their answers will vary depending on what they bring from home. Assist learners who have trouble implementing the instructions.

Teaching the lesson

Energy loss (wasted energy) LB p. 124

Go through the examples given in the Learner's Book. At the end of this section, learners should realise that energy can be wasted and that they can conserve energy.

ACTIVITY 5 Consider ways to reduce energy loss LB p. 126

Learners work in groups.

1. Learners discuss the reason for electricity usage warnings that are broadcast on television. Encourage discussion around this topic. Learners should realise that the message is a result of high electricity usage in homes. Many people watch television and this is a good way to communicate with the people. If everyone turns off the unnecessary appliances, the electricity consumption will go down.
2. Learners' captions will vary, but will focus on the fact that the newer energy-saving light bulbs are better than the old type for reducing energy loss.
3. Learners create a poster to explain how we can save electricity.

Unit 4.3 Illegal connections LB p. 126

Resources needed

- Drawings of safety signs

Teaching the lesson

Illegal electrical connections LB p. 126

Be sensitive while discussing this. Some learners only have electricity due to illegal connections. Rather focus on the dangers.

ACTIVITY 6 Consider the dangers of illegal electrical connections LB p. 127

Learners work in groups.

1. Electrical shock and electrical fires
2. a) Legal connections are insulated and in a electrical box so that no one without knowledge of electricity can touch it.
   b) The illegal connections are open and exposed to the weather and people can touch them. When wires are exposed you can easily get an electrical shock.

Unit 4.4 Renewable ways to generate electricity LB p. 128

Resources needed

- Drawings books, posters or DVDs of renewable ways to generate electricity, including examples of wind power generators, solar power generators, hydro-electric power generators

Teaching the lesson

Systems for using wind energy LB p. 128

Work through the content in the Learner's Book with the learners. If possible, have books, posters or DVDs on this topic available for learners to view.

Systems for using water energy LB p. 129

Work through the content in the Learner's Book with the learners. If possible, have books, posters or DVDs on this topic available for learners to view.

Systems for using solar energy LB p. 129

Work through the content in the Learner's Book with the learners. If possible, have books, posters or DVDs on this topic available for learners to view.

Systems for using elastic energy LB p. 131

Work through the content in the Learner's Book with the learners. If possible, have books, posters or DVDs on this topic available for learners to view.

ACTIVITY 7 Review energy sources, systems and uses LB p. 132

Learners work in groups.

1. a) Learners discuss the drawings in the Learner's Book. They should be able to identify the source and uses of energy in each drawing.
   b) Learners discuss the similarities and differences of the source and uses of energy in the past and today.
   c) Learners create a table on a piece of newsprint or cardboard to summarise their discussions.
2. a) Learners identify three energy systems and transfers in photographs, e.g. wind energy, solar energy, water energy.
   b) Learners write the energy systems and energy transfers in the form of a flow diagram.

Revision: Test LB p. 133

1. Allocate marks for neatness, accurate representation of the information given, use of the correct international symbols and the key. (4)
2. a) A conductor is a material that allows electricity to flow through electric circuits. An insulator prevents electricity from flowing. (2)
   b) Conductor: copper
   Insulator: rubber (2)
3. a) Fossil fuels are the remains of dead plants and animal which were trapped in the Earth's crust millions of years ago. (4)
   b) Through heat and pressure. They contain energy which is released when the are burnt. (4)
   c) No. There is a limited amount of fossil fuels on Earth, and because fossil fuels take millions of years to form they cannot be quickly produced and used. (2)
4. a) The Sun is the source of all energy. (2)
   b) It provided the energy for the plants and animals which were trapped in the Earth's crust millions of years ago and formed fossil fuels. These fossil fuels are burnt in power stations to create the electrical energy which is used to power your kettle. (3)

c) You can use geysers effectively, unplug appliances when they are not in use and switch off lights when you are not in the room. (Accept any reasonable answers.) (2)

5. Illegal electricity connections are dangerous because they are often unstable and can cause electric shocks. They also waste energy. (2)
6. a) Energy that does not run out; it comes from resources that can be replenished, such as wind, sunlight and rain. (3)
   b) Solar, wind or hydro-electric energy (2)
7. Learners' own descriptions should reflect an understanding of the concepts of conductors and insulators as they relate to damaged electrical cable. For example: The metal wires inside the cable conduct the electricity. If the plastic coating is damaged, these metal wires are no longer insulated, and you can get an electrical shock if you touch the wires. (2)
8. a) 1. Coal is transported from a coal mine to a power station.
      2. At the power station, the coal is ground into a fine powder.
      3. The ground coal then goes into a furnace where it is burned.
      4. The heat generated from the burning coal is used to boil water in a huge boiler.
      5. The boiling water produces steam that turns a turbine (a turbine is a big wheel which turns).
      6. The turbine is linked to a generator which uses a coil to produce energy. (6)
   b) Generation of electricity (1)
9. Accept any reasonable explanation that shows learners' understanding of the importance of wind energy as a renewable form of energy production that should be developed as an alternative to only relying on coal (which is non-renewable) for generating electricity. (4)

TOTAL: 45 MARKS

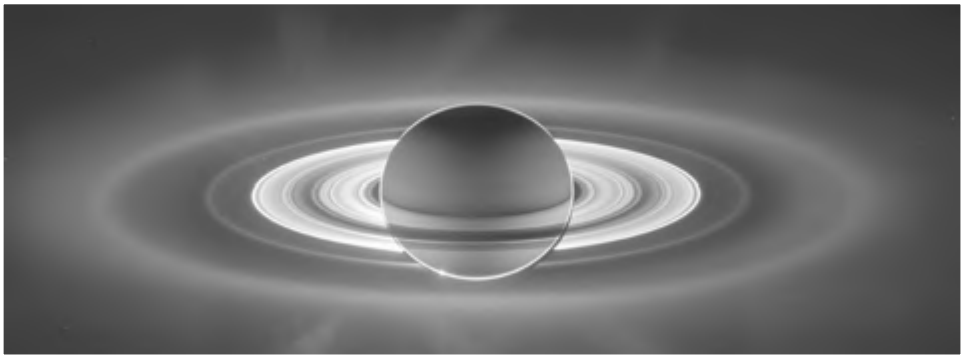
Enrichment tasks

There are many educational websites that provide worksheets for interesting additional activities about electricity, including how to make simple electrical toys. You can, for example, look at the following site for ideas that you can print out for learners to make themselves: www.scitoys.com.

A Google search for 'make simple electrical toys' will lead you to various sites that can be used for suitable extension activities.

TERM 4

Natural Sciences: Planet Earth and beyond Technology: Systems and control



TERM 4
Natural Sciences: Planet Earth and beyond Technology: Systems and control

TOPIC 1: The solar system
Unit 1.1 The Sun, planets and asteroids
Unit 1.2 Moons

TOPIC 2: Movements of the Earth and planets
Unit 2.1 Rotation (Earth)
Unit 2.2 Revolution (Earth)

TOPIC 3: The movement of the Moon
Unit 3.1 Rotation (of the Moon)
Unit 3.2 Revolution (of the Moon)

TOPIC 4: Systems for looking into space
Unit 4.1 Telescopes

TOPIC 5: Systems to explore the Moon and Mars
Unit 5.1 Vehicles used on the Moon
Unit 5.2 Vehicles used on Mars

Topic 1

The solar system

$8\frac{3}{4}$ hours

Curriculum content and concepts

The Sun, planets and asteroids

- The Sun (a star) is at the centre of our solar system
- There are eight planets and the asteroid belt (Mercury, Venus, Earth, Mars, asteroid belt, Jupiter, Saturn, Uranus and Neptune) in orbit around the Sun
- Each planet has its own:
  - features, size, orbit and position in relation to the Sun, composition (rocky and gas planets) and number of moons (some have no moons)
- The planets and asteroids take different amounts of time to revolve around the Sun.

Moons

- Moons, including our Moon do not give out their own heat or light
- Our Moon can be seen from Earth because the light from the Sun shines onto its surface
- On the Moon we can see craters, lighter areas which are mountains, and darker areas which are flat plains.

Resources needed

- Globe to explain movement of the Earth
- Poster of the solar system
- Photographs and extra information about the solar system: www.nasa.gov is an excellent source of additional information, with special sections for learners and educators
- DVDs or recordings of TV documentary programmes about the solar system, if possible
- If you live in or near a city or town that has a bookstore, look out for children's books about space to add to your own class collection. There are, for example, many books available that have pop-up models of the solar system that help learners to get a better understanding of space concepts. Encourage learners to bring such books to show to the class if they have them at home.
- If you live in or near a centre that has a planetarium, try to arrange a class outing.

What do you already know? LB p. 136

Let learners work in pairs to do this baseline assessment activity, which assesses what they can remember about some of the space-related concepts that they learnt about in previous grades. Let pairs share their answers with the class, and use this as an opportunity to make sure that they still remember correctly what they learnt in previous grades. If any aspects need further attention, you can focus more strongly on these in the different units that follow.

1. h
2. f
3. e
4. a
5. c
6. m
7. b
8. d
9. l
10. k
11. n
12. i
13. j
14. g

ACTIVITY 1 A class quiz LB p. 137

True or False

Learners work with a partner.

1. False: The Earth rotates on its own axis. This causes day and night. OR The Earth revolves in an orbit around the Sun. This results in a year that is equal to $365\frac{1}{4}$ days.
2. False: The Moon revolves around the Earth.
3. True
4. False: There are eight planets in our solar system.
5. False: An astronomer is someone who studies the stars through a telescope. OR An astronaut is someone who travels into space in a spaceship.
6. False: A crescent Moon is when only a sliver of the Moon is visible.
7. False: *Curiosity* is an unmanned spacecraft that landed on Mars.

Complete the sentences

1. astronaut
2. telescope
3. Mars
4. atmosphere
5. rotation
6. Pluto
7. satellites
8. Voyager

Unit 1.1 The Sun, planets and asteroids LB p. 139

Resources needed

- Detailed drawings and models of the solar system

Teaching the lesson

Read and discuss the content on pages 139 and 140 with learners. Learners should have a clear understanding about the composition of the Sun, its size, its distance from the Earth and that all the objects in our solar system revolve around the Sun. Discuss the text on pages 144 to 145 with learners. They should have a good grasp of the differences between a planet, star, asteroid and meteorite. Discuss the largest asteroids that have been classified as dwarf planets.

ACTIVITY 2 Research and draw the solar system LB p. 146

Learners work in small groups.
Learners do research about the planets and bring it to school. They write down the information for Part 1 a)–e). For Part 2, each learner must be assigned a couple of planets to draw. Once the drawings are done, they paste them on an A2 manilla sheet. For Part 3, one learner of each group will present their poster to the class.

Unit 1.2 Moons LB p. 146

Resources needed

- Drawings of the moons on different planets

Teaching the lesson

Read and discuss the text on pages 146 to 148 with the learners. This text is not essential knowledge and is just interesting information about the different moons. It is only the Earth's Moon that will be done in detail.

Topic 2

Movements of the Earth and planets

$3\frac{1}{2}$ hours

Curriculum content and concepts

Rotation (Earth)

- In the solar system, each planet rotates (spins) on its own axis
- The planet Earth is spinning, and one complete rotation takes about 24 hours; we experience this as day and night
- During rotation, the side of the Earth facing the Sun experiences daytime, and the opposite side of the Earth experiences night time.

Revolution (Earth)

- All planets also revolve (travel) around the Sun in their own orbits.
- Planet Earth revolves around the Sun in its own orbit (pathway), and one complete revolution takes $365\frac{1}{4}$ days, we experience this as a year.

Unit 2.1 Rotation (Earth) LB p. 149

Resources needed

- Models and a light source such as a torch, lamp or candle to demonstrate the movements of the Earth.

Teaching the lesson

Use as many resources as possible when explaining this content. Some learners may find it difficult to comprehend the simultaneous rotation and revolution of the Earth. Learns should have a clear understanding of the position of the Earth, that it is tilted on its axis and that the angle stays the same, even thought it rotates and revolves around the Sun.

Learners have to know where the Equator is to be able to understand northern and southern hemisphere. It is important that they understand that the Sun's 'rising' and 'setting' is actually the result of the Earth's rotation.

Unit 2.2 Revolution (Earth) LB p. 151

Resources needed

- Models and a light source such as a torch, lamp or candle to demonstrate the movements of the Earth

Teaching the lesson

Learners must know the difference between a rotation and a revolution. They have to know how long it takes the Earth to complete both. Discuss the key words thoroughly and test the learners on it from time to time. During this year the learners do not have to learn the detail of how seasons are formed, but it is important that they understand the short version given on pages 152 to 153.

Try to make a large poster of the drawing on page 152 to demonstrate how the Sun sometimes lights up the southern hemisphere for longer and other times the northern hemisphere. Draw Africa prominently to orientate the learners.

ACTIVITY 1 Describe and demonstrate how the Earth moves LB p. 154

Learners work with another learner.

1. The Earth rotates once every 24 hours around its axis. At the same time it revolves around the Sun. This is called a revolution and one revolution takes $365\frac{1}{4}$ days to complete. The Earth remains in the same position while rotating on its axis and revolving around the Sun.
2. Learners' answers will vary.
3. Sunlight lights up one half of the Earth during its rotation. This part will have day and the dark part will have night. As the Earth rotates once every 24 hours, it will have a day and a night in that period. As the Earth rotates in front of the Sun, it may appear that the Sun rises in the East and sets in the West. It is just that part of the Earth being lit by the sunlight as the Earth's rotation exposes that side to the Sun. It takes more or less 12 hours to turn away from the Sun again into darkness (night).
4. Learners' answers will vary.

ACTIVITY 2 Find out how long other planets take to complete a rotation and revolution

LB p. 155

Learners work on their own. This activity develops their ability to apply information from a table to answer questions.
Answers are in Earth days and hours

1. Mercury – 1 day = $29\frac{1}{2}$ Earth days
   Venus – 1 day = $121\frac{1}{2}$ Earth days
   Mars – 1 day = $12\frac{1}{2}$ Earth hours
   Jupiter – 1 day = 5 Earth hours
   Saturn – 1 day = 5 Earth hours
   Uranus – 1 day = 9 Earth hours
   Neptune – 1 day = $9\frac{1}{2}$ Earth hours
2. Mercury – about 249 times $[(60 \times 365\frac{1}{4}) \div 88]$
   Jupiter – 5 times
3. Neptune is much further away from the Sun than the Earth and its orbit around the Sun would therefore be much larger and take longer.
4. $88 \div 4 = 22$. Each season would be about 22 days.
5. Let learners come up with their own suggestions, using the information that follows to guide the discussion to develop their critical thinking skills. Each planet has its own unique rotation time. In part it is dependent on the mass or density of the planet, whether it has water (tidal forces) or not. The rotation speed may also have been influenced by how the planet was formed and if it had been hit by heavy objects in space. One day on Venus, for instance, takes longer than one year in Earth time. Venus' rotation time is slower than one revolution around the Sun.

How are you doing? LB p. 155

Take this opportunity to ask learners if there is anything that they do not understand. You can check their understanding by asking them sone questions about the information covered in the topic. Explain anything that they do not understand.

Topic 3 The movement of the Moon

$3\frac{1}{2}$ hours

Curriculum content and concepts

Rotation (of the Moon)

- The Moon rotates on its axis and a rotation takes about 28 days

Revolution (of the Moon)

- The Moon revolves around the Earth and one revolution also takes about a month (about 28 days)
- Together, the Earth and Moon revolve around the Sun

Resources needed

- Models and a light source such as torch, lamp, or candle to demonstrate the movements of the Moon

Unit 3.1 Rotation (of the Moon) LB p. 156

Teaching the lesson

Read and discuss the text on page 156 with learners. This builds on what they have already learnt about the Moon in Grade 4. Distinguish between rotation (on its own axis) and revolution (around the Earth), and together with the Earth, around the Sun.

Unit 3.2 Revolution (of the Moon) LB p. 157

Teaching the lesson

Explain why only one side of the Moon is ever visible from Earth. The Moon does not shine, it only reflects the Sun's light in various degrees. That is why we see different Moon shapes from Earth.

The phases of the Moon **LB p. 157**

Discuss the diagram on pages 157 and 158 thoroughly. First look at the new Moon. The side facing the Earth is dark because the sunlight cannot reach the front. Its direct opposite is the full Moon where the half of the Moon that we see receives and reflects sunlight. Although we see only half of the Moon, it still appears as a round disc in space.

Discuss and refresh the learners' knowledge about the different phases of the Moon, which they learnt about in Grade 4.

ACTIVITY 1 Compare drawings about the phase changes of the Moon LB p. 159

Learners work in groups.

1. a) Learners compare the diagram of the Moon's orbit around the Earth to the photographs of the different phases of the Moon.
   b) Learners discuss how the phases of the Moon change as the Moon orbits the Earth.
   Demonstrate the parts of the Moon being lit by using a torch as the Sun. One learner acts as the Earth (standing still for this demonstration) and a second learner walking in a circle around the Earth with a white disk facing the 'Earth' at all times. Stop the learner as he passes between the Sun and the Earth (new moon) and when the Earth is between the Moon and the Sun (full moon) to orientate learners.
   The Moon orbits the Earth once every 28 days. It rotates from west to east. Take note where the Moon begins to 'grow' (wax) and where it starts to 'wane'.
   c) About 14 days
   d) Literal meaning: A blue Moon is the occurence of a second full moon in one month. Figurative meaning: Once in a blue moon – it happens rarely, not very often.

Learners work on their own.

2. a) Learners describe the shape of a crescent moon.
   b) Learners describe the shape of a gibbous moon.
   c) Learners describe the shape of a full moon.

PRACTICAL TASK – ACTIVITY 2 Construct a model of the Sun, Earth and Moon LB p. 159

Learners consolidate what they have learnt about the Earth, Moon and Sun within the solar system to construct a model of these three elements of the solar system. Revise with them what they have learnt this term. Although the model does not need to be exactly to scale, they should be able to use and apply the information learnt earlier in the term about the relative sizes of the Sun and Moon, compared to the Earth. Their models should also reflect what they have learnt about the nature of the Earth, Moon and Sun, for example that the Sun is a source of heat and light, and the Earth is known as the Blue Planet (and is covered with oceans and continents). Encourage learners to use waste materials to construct their models. If you wish to select this as a project for formal assessment (marks to be recorded in Term 4), you will need to develop a checklist so that learners know how they will be assessed. We would, however, rather recommend that this be done as a fun activity that allows learners to express their creativity, while also showing their basic understanding of what they have learnt.

Topic 4 Systems for looking into space

$3\frac{1}{2}$ hours

Curriculum content and concepts

Telescopes

- Telescopes are used to look into space and gather information
- South Africa has built some of the largest telescopes

Unit 4.1 Telescopes LB p. 160

Resources needed

- Drawings and information about telescopes

What do you already know? LB p. 160

1. Learners' answers will vary. They will probably respond that they see stars and the Moon. Some might say that they see shooting stars.
2. Learners will probably respond that they do see better with binoculars or through the zoom lens of a camera.
3. Dark shadows/pits/pockets
4. No
5. No
6. Learners' answers will vary.
7. A shooting star is actually a meteorite as it moves through the Earth's atmosphere. The friction caused by this appears as the streak of light across the sky.
8. Yes, Venus is visible as the 'evening star'.

Teaching the lesson

Read and discuss the text on pages 160 to 162 with learners. Ask learners to share their knowledge about the SALT and the SKA-project currently underway in Carnarvon. Useful websites on these are: www.salt.ac.za and www.ska.ac.za.

How are you doing? LB p. 162

Take this opportunity to ask learners if there is anything that they do not understand in the topic. You can check their understanding by asking them some questions about the information covered in the topic. Explain anything that learners do not understand.

Topic 5 Systems to explore the Moon and Mars

8¾ hours

Curriculum content and concepts

Vehicles used on the Moon

- A few people have visited the surface of the Moon and explored it using a vehicle called a Moon rover.

Vehicles used on Mars

- Robots called Mars rovers have been used to visit and explore the surface of Mars (people have not yet visited Mars).

Unit 5.1 Vehicles used on the Moon LB p. 163

Resources needed

- Pictures of the Moon and Mars rovers
- Recent articles from newspapers or websites such as www.nasa.gov about the latest developments in space exploration.
- Apparatus including bottle tops or lids, round tins or cardboard circles for the wheels, sosatie sticks or dowels and straws for the axles.

Teaching the lesson

Discuss the content in the Learner's Book. Focus on the wheels used in the different vehicles and how to make the vehicles move.

ACTIVITY 1 Design and make a vehicle to collect soil on the Moon LB p. 163

Recap on the technological process used earlier. Explain the design brief to make sure learners know what they need to do. Learners can use the checklist below to access their vehicle.

Ask yourself:	Yes	No	How can I make it better?
Can your rover carry Moon soil back to your Moon spacecraft?			
Do the wheels roll easily?			
Does it go in a straight line, or does it go in a curve?			
Does the rover have a model of the astronaut sitting on it?			
Is there place for the soil?			
Is the body of the rover strong enough?			

A photocopiable version of this checklist is available on page C7.

Unit 5.2 Vehicles used on Mars LB p. 173

Resources needed

- Drawings of the Moon and Mars rovers

Teaching the lesson

Refer to the text on page 163 in the Learner's Book and discuss what they can use to make their Moon rover move and pick up soil. Discuss step-by-step what the learners need to do. As you discuss each part, the learners can do it practically with you. Encourage learners to help each other. Walk around in the classroom to make sure that all learners understand and can follow. Where possible, have examples to show learners what to do. Some learners learn better with a practical example. Learners must evaluate their products by racing against each other. Make sure it is a fair test. Some groups can talk about what they have done and why it worked or didn't work.

ACTIVITY 2 Answer questions about Mars rovers LB p. 175

1. *Pathfinder* – smallest wheel
   Opportunity – middle wheel
   Curiosity – largest wheel
2. It depends on the work the vehicles had to do.
3. To make the vehicles move more easily.

Revision: Test LB p. 176

Section A: Energy and change

1. a) Allocate marks for neatness, use of the correct international symbols and accurate representation of the information given (the switch must be open). (4)
   b) The cell is the source of energy for the electric circuit (it is the input energy). (1)
   c) The switch breaks or completes the circuit pathway. (1)
   d) When an electrical cell is on its own it is called a cell, when there is more than one cell as a source of energy it is called a battery. (2)
2. a) A conductor is something that carries electricity well. An insulator is something that does not allow the flow of energy. (2)
   b) Insulators: rubber, wood, plastic
   Conductors: copper, iron, steel, water (1)
   c) The plastic coating acts as an insulator and prevents electric shocks when we touch the cable. We call this an insulator. (3)

3. a) Coal, oil, natural gas (3)
   b) The diagram must contain the following information: Layers of dead plants and animals form in swampy ground → these are slowly covered by layers of mud, water, soil and sedimentary rock, and form part of the Earth's crust → millions of years of heat and pressure turn the organic matter into coal, oil and natural gas. (4)
   c) Any two renewable sources of energy (e.g. wind energy, solar energy, water energy) and their advantages (renewable, does not release harmful waste products) and disadvantages (can be expensive to implement, not always consistently available e.g. solar energy cannot be produced at night). (4)
4. Accept any reasonable explanation that shows learners' understanding of the importance of not continuing to rely only on coal (a non-renewable resource) for generating electricity, and which emphasises the importance of developing alternative renewable energy sources, such as wind and solar energy. Their paragraphs should reflect an understanding of the difference between renewable and non-renewable resources. (5)

Total Section A: 30 marks

Section B: Planet Earth and beyond

1. a) The solar system consists of the Sun, the planets and their Moons, and bodies such as asteroids and comets. (2)
   b) Planets orbit the Sun. Moons orbit the planets and follow them in their orbit around the Sun. Asteroids are smaller bodies of rock which also orbit the Sun. The larger asteroids are now classified as dwarf planets. (3)
   c) The inner planets are terrestrial planets made of rock, while the outer planets consist of gas. (2)
2. a) 24 hours (1)
   b) This movement causes day and night. When one side of the Earth is facing the Sun that side experiences daytime, and when it is turned away from the Sun it experiences night-time. (2)
   c) $364\frac{1}{4}$ days (1)
   d) This movement causes the seasons. The Earth is tilted on its rotational axis; therefore the northern and the southern hemisphere are not equally distant from the Sun. As the Earth moves around the Sun, the hemisphere that is closer to the Sun experiences summer and the hemisphere that is further from the Sun experiences winter. (2)
3. a) The Moon takes the same amount of time to rotate on its axis as it does to revolve around the Earth (28 days). Therefore, one side of the Moon is constantly turned away from the Earth. (2)
   b) The Moon is illuminated because it reflects the Sun's light. As the Moon makes its way around the Earth we see the bright part of the Moon at different angles. These are the phases of the Moon. (1)

c) Any three phases (e.g. new Moon, gibbous Moon, full Moon, crescent Moon) and a brief description of what each one looks like. (3)

4. a) Telescopes are used to look into outer space and gather information about the universe. (1)
   b) SALT (South African Large Telescope)
   SKA
   MeerKAT (Any 1) (1)
5. Although humans have not yet visited Mars, we have sent vehicles called rovers to explore and obtain information about the planet.
   a) Any logical explanation, e.g. Mars is far away and it would take a long time to get there. (1)
   b) Wheels and axles, a system for communication, a system for gathering information (3)
6. a) Learners should indicate whether they agree or disagree.
   b) Learners' reasons for why they agree or disagree should reflect their own opinions (for *or* against) the type of space research done by SALT and the SKA. For example, they may argue that they agree it is a waste of money as we can leave it to richer countries such as the USA to do such research. Or they could argue that it is not a waste of money, as it helps to create employment in the towns where these projects are, that the scientific knowledge is very important and that it allows South African scientists to take part in research with scientists from all over the world. Whatever their views are, they should be able to express a simple but clear opinion for *or* against this type of research. (5)

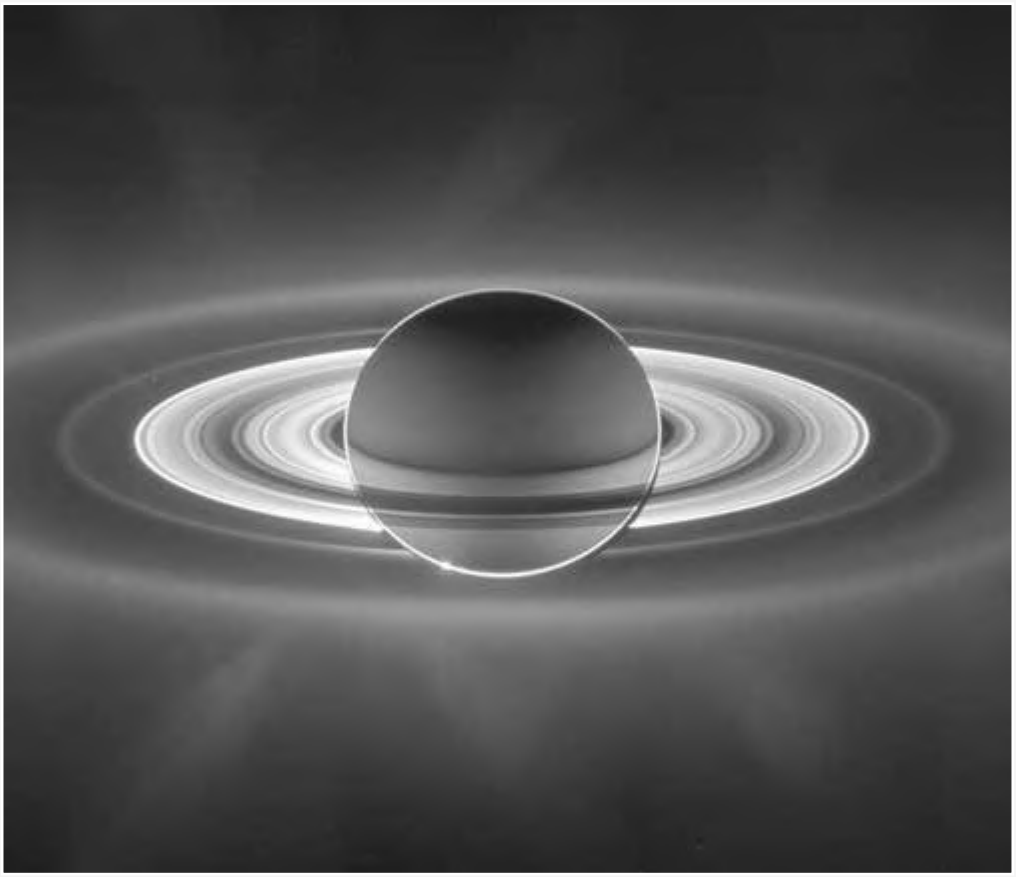
Total Section B: 30 marks

TOTAL: 60 MARKS

Enrichment tasks

There are many educational websites, for example the NASA website (www.nasa.gov), that offer fascinating practical activities on space-related topics.

Section C: Photocopiable resources



This part of your Teacher's Guide is for storing all photocopiable templates, worksheets, and resources that are provided and that you may come across in your planning and research.

Teacher assessment

Term 2 Topic 4 Unit 4.1 LB p. 78

Practical Task: Activity 3: Conduct a fair test about factors that influence the rate of dissolving

Name of learner:_____ Date: _____
Mark: _____ *adapted to* _____ _____% Code: _____
30 15

Criteria	Level 1	Level 2	Level 3	Level 4	Level 5
Learner's planning is thorough and well written.					
Learner is clear about the purpose of the investigation and has made a logical prediction of the outcome.					
Learner conducted a fair test.					
Learner conducted the investigation safely and correctly.					
Learner was able to report his/her findings correctly in a suitable graph with correct labels and heading.					
Learner was able to reach the correct conclusion about the influence that the investigated factors had on the rate of dissolving.					

Key to levels

Level 1	Learner made no attempt to meet the criteria.
Level 2	Learner attempted the criteria but was unable to complete them successfully.
Level 3	Learner managed an acceptable level of completion of the criteria.
Level 4	Learner understood the requirements and completed the criteria successfully and correctly.
Level 5	Learner showed exceptional knowledge and skill in the correct completion of the criteria.

Teacher's signature and comment: _____

_____

_____

Self-assessment checklist for writing a report

Term 2 Topic 5 Unit 5.2 LB p. 86

Activity 2: Research and write a report about a wetland

Use the checklist below to check that you have done what you needed to do for your report. If there is something you forgot to include, fix it before you both hand in your reports. You must work together to do your research and to plan your reports, and to write the first draft and the final report. Write both your names on the report.

Names: _____

_____

Criteria	YES	NO
1. We based our case study on a selected ecosystem.		
2. We did further research about our selected ecosystem.		
3. We made notes of all our research and selected the information we wanted to include in the report.		
4. We included the following aspects in our research and final report: a) the history of the wetland b) the nature of the ecosystem in the wetland, including the plants and animals found there c) threats to the wetland d) suggestions for ways to overcome these threats.		
4. We structured the report to have clear paragraphs in a logical sequence.		
5. If we based our case studies on the examples of wetlands in the Learner's Book, we did further research which formed the main part of our final report.		
6. The report has a clear introduction and conclusion.		
7. We included appropriate visual materials, such as drawings and graphs in suitable places in the report.		
8. The report has a clear heading, and we also used sub-headings where necessary in the report itself.		
9. We wrote our names on the report.		
10. We checked our report carefully for spelling, language and other errors.		

Your teacher will also give you a copy of the checklist for presentations that she will be using to assess your team's report. This mark will be used for both you and your partner, so you need to work together to get the best mark you can.

Checklist for self-assessment for the Practical Task

Term 3 Topic 3 Unit 3.1 LB p. 112

Activity 3: Design and make a simple alarm system

Name: _____

	Criteria	☺	😐	☹	Comments
1	We did some research to find out how an alarm system works.				
2	Our design brief shows clearly what we need to do to solve the problem.				
3	We listed specifications and constraints.				
4	Our design shows how the alarm system will look and how the components will be connected.				
5	We made a list of the tools and materials we will need.				
6	We sequenced our work.				
7	It was easy to make the alarm system and we evaluated the design.				
8	We worked neatly.				
9	We used the materials responsibly.				
10	We presented our project to the class.				

Checklist for group activity for the Practical Task

Term 3 Topic 3 Unit 3.1 LB p. 112

Activity 3: Design and make a simple alarm system

Names: _____

	Criteria	7	6	5	4	3	2	1	Comments
1	We worked well together.								
2	Our alarm system looks well put together.								
3	We worked neatly and safely.								
4	The system adheres to the design brief and specifications.								
5	The system looks like the drawing we made.								
6	We shared the work and took turns to work with the equipment.								
7	The system does what it is supposed to do.								

Rating code

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

If you had to make an alarm system again, is there anything you would change?

_____

_____

If yes, what would you change?

_____

_____

Teacher assessment

Term 3 Topic 3 Unit 3.1 LB p. 112

Analytical rubric for learner progression: PRACTICAL TASK – Activity 3: Design and make a simple alarm system

Learner's name: _____

Criteria	10 Points	7–9 Points	4–6 Points	1–3 Points	Mark
Participation	Volunteers to do work	Sometimes volunteers	Only does something when asked to	Very seldom participates	
Remains focused on the task	Very focused on the task	Mostly focused on the task	Sometimes focused on the task	Not focused on the task at all	
Used materials responsibly	Used materials responsibly	Mostly used materials responsibly	Sometimes used materials responsibly	Did not use materials responsibly	
Cleaned area before leaving	Workplace was always neat	Workplace was mostly neat	Workplace was sometimes neat	Workplace was mostly a mess	
Problem solving	Solved the problem perfectly	Some limitations	Needed more work to solve the problem	Did not solve the problem at all	
Creativity	The learner's work demonstrated a unique level of originality	The learner's work demonstrated originality	The learner's work lacked originality	The learner's work showed little or no evidence of original thinking	
Skills	Learner demonstrated high level of skills	Learner demonstrated a fair level of skills	Learner demonstrated minimum level of skills	Learner demonstrated no level of skills	
Design	Design was neat, labelled and well thought through	Design was neat, labelled but not so well thought through	Design was neat, not labelled, not well thought through at all	Design was untidy, unlabelled with no clear thinking	
Time management	Learner managed time wisely and finished well within time	Learner managed time well but didn't finish in time	Learner didn't manage time wisely and didn't finish on time	Learner played around and was not finished on time	
Demonstrated knowledge	Excellent demonstration of knowledge	Good demonstration of knowledge	Fair demonstration of knowledge	Very little demonstration of knowledge	
				TOTAL	

Teacher's comments:

Teacher's signature: _____ Date: _____

Checklist for individual activity

Term 4 Topic 5 Unit 5.1 LB p. 163

Activity 1: Design and make a vehicle to collect soil on the Moon

Ask yourself:	Yes	No	How can I make it better?
Can your rover carry Moon soil back to your Moon spacecraft?			
Do the wheels roll easily?			
Does it go in a straight line, or does it go in a curve?			
Does the rover have a model of the astronaut sitting on it?			
Is there place for the soil?			
Is the body of the rover strong enough?			

Worksheet 1: Food groups

Term 1 Topic 2 Unit 2.1 LB p. 20

Activity 1: Sort foods and create a table

Day	**What I eat from each food group**			
	Proteins	Fats and oils	Carbohydrates (starches and sugars)	Vitamins and minerals
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
Saturday				
Sunday				

Worksheet 2: Food groups

Term 1 Topic 2 Unit 2.1 LB pp. 20–21

Activity 2: Match the food to the nutrient group

Food type	Carbohydrates (sugar and starch)	Proteins	Fats and oils	Vitamins and minerals
Peanuts		X	X	X

Worksheet 3: Guidelines for Practical Task

Term 2 Topic 4 Unit 4.1 LB p. 78

PRACTICAL TASK – Activity 3: Conduct a fair test about factors that influence the rate of dissolving

When we design an experiment to test the influence of two variables on the rate of dissolving, we need to set up our experiment properly to ensure that it will be a fair test:

- What do we wish to test?
- How can we make sure we are testing what we are setting out to test?
- Is our methodology correct, and appropriate?
- Are our results accurate and unbiased?

Our experiment

- We will test the influence of temperature and grain size on the rate at which substances dissolve.
- We will hold everything constant (volume of water used, size of beakers used, heat source) and only alter one variable at a time (temperature and grain size).
- We will use 200 ml glass beakers (or larger beakers, it doesn't matter, as long as all the beakers are the same volume and shape). Our heat source can be a gas ring, or a hot plate, but not both. We will not stir one beaker, and not the others. If we do decide to stir, each beaker will be stirred with exactly the same type of rod or spoon, clockwise (or anti-clockwise, but not both), and for exactly the same length of time.
- Ideally, all the experiments should be carried out by the same person! This reduces unintentional operator bias.

Carrying out the experiment

It is not necessary here to explain or go through the same procedure over and over for each substance used. You will follow the same basic steps for all the parts of your experiment.

- We suggest you take sugar lumps, coarse sugar, and fine icing sugar for your experiment.
- The same experiment can be repeated with very coarse salt, medium salt and fine salt.
- Another nice contrast is a stock cube, a crushed stock cube, and a finely ground stock cube, because these will colour the water, making an even bigger impact.

All three solutions (sugar, salt, stock cube) can be tasted along the way to see if dissolving (dissolution) is occurring!

Here is the sugar example:

1. Weigh four sugar cubes (about 50 g)

2. Now, weigh exactly the same amount of table sugar (same weight as the cubes) and the same amount of icing sugar (finer grain size than the ordinary sugar).

3. Place the cubes, the sugar and the icing sugar in three separate, identical beakers, and cover the different sugar samples with exactly the same amount of water (100 ml or 200 ml) poured from the same container (this ensures the same temperature for each solution).

4. Record how long it takes each to dissolve completely at room temperature.

5. Repeat the experiment in exactly the same way, but this time, place all three beakers on the same hot plate at the same time, turn it on to low heat, and see how long the sugar takes to dissolve.

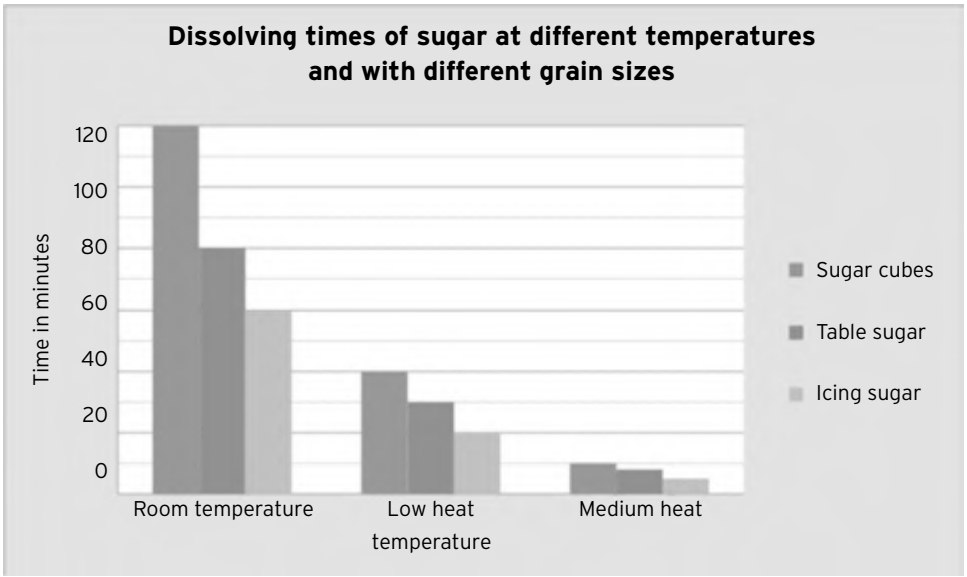
6. Repeat the experiment a third and final time, but this time, turn the hot plate to medium (not high, we don't want it to boil).

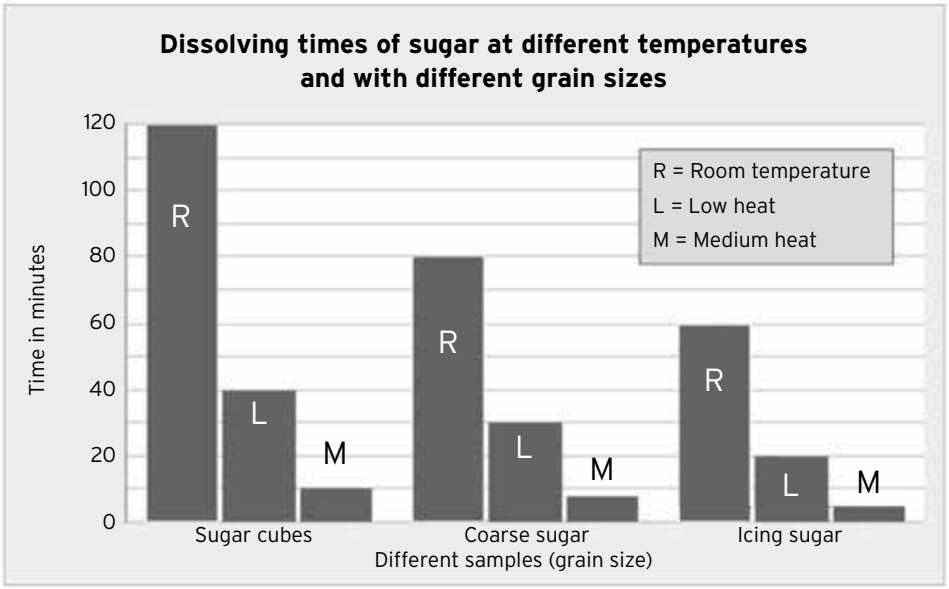
7. Record your results and draw graphs as in the examples on the next page to show the results.

Important notes: You must use transparent glass beakers, not tins, so that you can see the sugar through the glass. Sugar at room temperature will not dissolve easily; you might need to undertake controlled stirring (see below).

Results
The above will give you a really useful set of data, with all results in minutes (and, if you want, seconds). There are two variables (grain size and temperature) but three different grain sizes and three different temperatures, giving you 3 x 3 = 9 different combinations of result. Of course, if you do the same experiment with salt, or stock cubes, you will generate even more results. You could also work just with sugar, and add another variable, the influence of stirring on the rate of dissolving. As long as you decide what you wish to do (which variable or factor to test) and you hold everything else constant, you have a FAIR TEST.

Here are some imaginary results, recorded in graph form:





Worksheet 4: Insulators

Worksheet 4: Term 3 Topic 2 Unit 2.2 LB p. 107

PRACTICAL TASK – Activity 2: Investigate the conductivity of different materials

Object	Conductor	Insulator
Metal spoon		
5 cent piece		
R1 coin		
Pencil		
Metal paper clip		
Plastic paper clip		
Cardboard		
Eraser		
Plastic spoon		
Plastic ruler		
Piece of wire		
Book		
Aluminium foil		
Drinking straw		

Worksheet 5: Using electric circuits

Term 3 Topic 3 Unit 3.1 LB p. 110

Activity 2: Complete a worksheet on energy transfers in systems

Learners' names: _____and _____

Object	Input: Energy from ...	Output: Energy changed to ...
		
		
		
		
		
		

Worksheet 6: Using electric circuits

Term 3 Topic 3 Unit 3.1 LB p. 112

Information sheet for PRACTICAL TASK – Activity 3: Design and make a simple alarm system

Understanding the activities of the technology process

Here is an explanation of what is involved in the design process for you to follow while doing this activity:

Investigate

Get a clear drawing of the problem or need you are going to solve. You have done some thinking about it and this is called investigation, which will lead you closer to the chosen idea.

Describe the situation

The description of the situation should be short, concise and open for interpretation. A situation arises out of life's circumstances and requires a practical problem to be solved.

Analyse the situation

When analysing the situation you need to identify the problem or need. Analyse the situation to sort out exactly what the problem is. You do this by identifying key words and looking at possible restrictions or constraints.

Investigate and research the given situation

- Once you have analysed the situation, you must now go and obtain as much information about the situation as possible. One learner will investigate and research the topic by making use of the library, the internet, collecting and recording data, identifying, questioning and analysing data.
- In your research, it is important to consider cultural and gender differences, as well as the effects your product is going to have on the environment.
- Other methods include making predictions, comparing and communicating data, observing, listening, interpreting, arranging and calculating data. All of the above forms part of your investigation and research.

Design

Write up a design brief

Once you have fully understood the problem, you need to write a design brief. A design brief is a short, concise and clear statement, which shows the general outline of the problem, which needs to be

solved. Your design brief should suggest possible solutions to solving your problem, as well as satisfying your wants and needs.

List your specifications

- Specifications are a list of requirements that your end product should fulfil. Specifications can also include a list of possible constraints.
- Your specifications should outline specific details of your design, and should explain the purpose of the product and what the product should be able to do.
- The list of specifications must be broad enough to allow for a variety of solutions.
- Specifications are a set of rules according to which the article is finally tested. Make a list of what is required in your brief and what the article will look like when it is finished. Below is an example of a specification list:

	Specification	Analysis
1	Design	It should be practical to make.
2	Material	This should be easily available.
3	Working time	It should be completed in a set time.
4	Cleanable	It should be easily cleaned.
5	Decoration	It should be colourfully painted.
6	Costly	Will it be expensive or not?
7	Practical	Can you use it?

Work out design proposals / initial ideas

- Now you should try and sketch possible solutions to your problem. These sketches should be done in pencil and can be either two-dimensional or three-dimensional (oblique or isometric).
- You may make use of grid paper.
- Combine your own ideas, as well as all the information you obtained from your investigation and research to complete your initial ideas.

Select preferred proposal / final idea and motivate your choice

This is the form of designing and finalising the proposal. It is important to develop the chosen idea into an acceptable practical article.

- You must now make a decision as to which is going to be your final idea.
- Consider the solution that best satisfies your specifications and best solves the problem.
- Once you have made your decision, motivate your choice, in full.
- Motivation should be based on a form of assessment. A common form of assessment, which can be used, is that of a rubric.
- Draw your final idea in colour.

- Can be two-dimensional or three-dimensional. For grades 4 to 6 only two-dimensional.

Develop final idea
- Your final or your chosen idea should now be prepared.
- Research final idea and consider various options for use in the final idea.
- Ensure all details and labels are included.

Draw up a set of working drawings – optional for Grades 4 to 6
During this stage you start making drawings. These are normally called the working drawings. They consist of the following:
- drawings with details
- part(s) of the article
- material list
- list of tools to be used
- decoration

Plan how to make the end product by using a flow chart
- Make use of a flow chart to indicate, step-by-step, the making of your end product.

Draw up a material list
- List all the material that is going to be used to make your end product.

Draw up a cutting list – optional
- List all the materials that need cutting and include the measurements.

Draw up a tool list
- List all the tools that have been used to make your end product.

Draw up a time schedule – optional
- Write down all the dates that you worked on and will work on for each section of your technological process.

Draw up a cost list – optional
- List the cost of all the materials purchased for your end product.
- Work out the cost of the amount of materials used.
- Total all amounts used to give a final amount.

List the safety requirements that need to be taken into account
- These will include correct and safe use of a range of tools, equipment and materials that have been used. Examples may include hand and power tools.

- The importance and application of first aid for cuts, bruises and burns.
- Safety and health hazards relating to toxic materials, fire, dust etc.

Make your final idea

- This is the stage where you finally make the article as planned.
- You will now collect the material and the tools required and use the skills you were taught while you worked on the project.
- Don't forget to set yourselves a programme, which you should follow, in order to keep track of your progress.
- Try to keep the quality of your workmanship high, because you and your friend or teacher will evaluate the end product.

Evaluate

- Now it is time to test your final product! You must now establish whether your final product meets the specifications and solves the problem.
- Remember that very few designs are perfect. When you evaluate your final product, you need to ask questions such as:
  - Is it effective and does it perform the intended function?
  - Does it meet with the required specifications?
  - Is it reliable?
  - Can the product be used safely?
- Lastly, list the faults, give possible improvements and include a conclusion.

Worksheet 7: The solar system

Term 4 Topic 1 LB p. 137

Activity 1: A class quiz

True or False
Write down if each statement is *True* or *False*. If it is *false*, write down a correct version of the statement.

1. The Earth revolves on its own axis. This causes a year that is equal to $365\frac{1}{4}$ days. _____

2. The Moon revolves around the Sun. _____

3. The Earth is much closer to the Moon than to the Sun. _____

4. There are nine planets in our solar system. _____

5. An astronaut is someone who studies the stars through a telescope.
   _____

6. A crescent Moon is when half of the side of the Moon facing the Earth is visible. _____

7. *Curiosity* is an unmanned spacecraft that landed on Jupiter. _____

Complete the sentences

1. Someone who travels into space in a spacecraft is called an _____.

2. SALT is a large _____ that is used to observe the stars.

3. The Earth lies between the planets Venus and _____.

4. The layer of air around the Earth is called the _____.

5. The Earth's _____ on its own axis causes day and night.

6. _____ was previously classified as a planet, but was then later renamed as a dwarf planet.

7. Man-made _____ orbit the Earth in a fixed path and are used for cell phone communication, GPS systems, etc.

8. The unmanned space probes that were sent into space to explore Jupiter and Saturn were called _____ I and II.

Sample mid-year examination

Nutrition and food processing

1. Circle the correct words in each sentence:
   a) Fats/carbohydrates/proteins are very important for the normal growth and development of the cells that are the building blocks of all living things. (1)
   b) Vitamin B/calcium/carbohydrates is a mineral that is important for the development of strong bones and healthy teeth. (1)
   c) We can use salt/turpentine/iodine to test if a food contains starches (carbohydrates). (1)
   d) Diabetes/obesity/kwashiorkor means that a person is overweight from eating too much sugary and fatty food. (1)

2. Describe how you would test if the air you breathe out contains carbon dioxide. (2)

3. List three reasons why we process food. (3)

4. a) Briefly describe three types of things that may be added to food and which could have a bad effect on our health. (3)

   b) Suggest why it is important to read food labels carefully. (2)

Ecosystems and food webs

5. Write two sentences to describe what each of the following ecosystems are like: 2 x 3 = (6)

   a) Deserts

   _____

   _____

   b) Grasslands

   _____

   _____

   c) Wetlands

   _____

   _____

6. Name two types of animals that live in each of the following ecosystems: 2 x 3 = (6)

   a) Oceans and seas

   _____

   _____

   b) Deserts

   _____

   _____

   c) Rainforests

   _____

   _____

Solutions and mixtures

7. Fill in the missing words. Use the words from the block.

solution	soluble	solvent	solute

a) If a solid can dissolve in a liquid, it is _____.

b) The result of what happens in statement (a) is a _____.

c) The substance that dissolves in a liquid is called the _____.

d) The liquid in which a substance dissolves is called the _____. (4)

8. Draw simple pictures to show:
   a) Picture A1: what happens when you add copper sulphate to water and stir it (2)
      Picture A2: what happens when you let this stand for a few hours (2)
   b) Picture B1: what happens when you add soil to water and stir it (2)
      Picture B2: what happens when you let this stand for a few hours (2)

Water pollution and the importance of wetlands

9. List three functions of water in ecosystems. (3)

_____

_____

_____

10. Complete each question by filling in the correct word: (3)

    a) Wetlands act like _____to preserve and regulate the flow of water.

    b) Wetlands also act like _____to purify water.

    c) Wetlands trap rainwater so that it sinks into the soil and forms supplies of _____. People can get access to this water by digging wells or boreholes.

11. a) Write down three ways in which people pollute water in ecosystems. (3)

_____

_____

_____

    b) For each of the types of pollution you write down above, suggest what can be done to prevent this type of pollution. (3)

_____

_____

_____

TOTAL MARKS: [50]

Memorandum for sample mid-year examination

Nutrition and food processing

1. Circle the correct words in each sentence:
   a) proteins (1)
   b) calcium (1)
   c) iodine (1)
   d) obesity (1)

2. Blow through a straw into clear lime water.

   The lime water will turn milky from the carbon dioxide in the air we breathe out. (2)

3. • to make it edible
   • to make it last longer
   • to improve the nutritional value (3)

4. a) Accept all reasonable descriptions reflecting an understanding of the health effects of food additives.
      • sugar to make things taste sweeter; could be dangerous for people with diabetes
      • preservatives, flavourants and colourants; to make food look and taste better – can have a bad effect on our bodies
      • artificial sweeteners – linked to illnesses such as ADHD and cancer (3)

   b) Accept all reasonable suggestions, e.g. that food labels warn us if foods are described in a misleading way (e.g. low-fat foods that contain lots of sugar, so it's just as fattening). (2)

Ecosystems and food webs

5. a) to c) Accept any reasonable answers that show an understanding of the key differences between ecosystems as explained in the Learner's Book. For example, deserts are dry and get almost no rain; and oceans have salt water. They should give two relevant points for each type of ecosystem. 2 x 3 = (6)

6. a) to c) Accept all logical choices of animals (either from the examples in the Learner's Book or from learners' general knowledge) that can be found in each type of ecosystem. (6)

Solutions and mixtures

7. a) soluble
   b) solution
   c) solute
   d) solvent (4)

8. Learners should be able to draw simple versions of pictures that reflect the following:

   a) Picture A1: Water turning purple as copper sulphate is added (2)

      Picture A2: Water will still be the same purple as in the second picture (2)

   b) Picture B1: Soil particles suspended in the water after stirring, i.e. showing cloudy water (2)

      Picture B2: Soil settled at the bottom of the container, with clear water at the top (2)

Water pollution and the importance of wetlands

9. Water as solvent – transport of substances

   Water provides habitats for plants and animals

   Dispersal of seeds (3)

10. a) sponges
    b) filters
    c) groundwater (3)

11. a) Accept any reasonable answers that reflect what they discovered in the Learner's Book, e.g. waste from pit latrines getting into rivers, pollution from waste from factories, car oil getting into rivers, etc. (3)
    b) Accept any reasonable solutions to the examples that they gave above, e.g. installing proper latrines instead of pit latrines, fining factories that dump waste into rivers, recycling car oil instead of dumping it, etc. (3)

TOTAL MARKS: [50]

Sample end-of-year examination

Electricity

1. Fill in the missing words. Use the words in the text box below. (6)

non-renewable	electrical charge	insulators
electrical current	renewable	conductors

a) The _____ of an object is a measure of how much electricity there is in it.

b) _____ are materials that carry electrical energy well.

c) _____ are materials that do not conduct electricity.

d) Coal is a source of _____ energy.

e) The wind is a source of _____ energy.

f) The movement of electrical charge is known as an _____ .

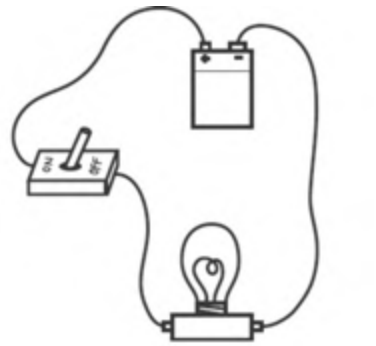
2. Complete the following table by adding the missing words or symbols. (5)

Component	Symbol
Open switch	
Cell	
Closed switch	
	

3. Which of the following are conductors and which are insulators? (8)

Object	Conductor	Insulator
Copper wire		
Plastic straw		
Wood		
Fabric		
Screw		
Coin		
Cardboard		
Key		

4. Redraw the following electrical circuit using the correct symbols to represent the components. (4)



5. You connected a bulb in series in a circuit and added an extra bulb for the circuit.

   a) Did both bulbs shine? _____ (1)

   b) Did they both shine with the same brightness? _____ (1)

   c) Explain what you observed when you connected the extra bulb. That is, give an explanation of why this happened. (2)

_____

_____

_____

_____

Planet Earth and beyond; Systems and control

6. Each of the statements below is False. Underline the incorrect word in each sentence. Then write down the correct word next to each sentence. (6)

   a) The Sun is a source of heat and light energy for all living things on the Moon.

   _____

   b) The Moon revolves in an orbit around the Sun.

   _____

   c) Mars is known as the blue planet.

   _____

   d) Pluto is a planet.

   _____

   e) The rings of the planet Mercury are made of millions of tiny ice-coated rock fragments.

   _____

   f) When the Moon is getting bigger, we say it is waning.

   _____

7. a) Explain why astronauts had to carry oxygen packs when they walked on the Moon. (1)

   _____

   _____

   b) Explain why astronauts needed to wear special suits when they landed on the Moon. (1)

   _____

   _____

8. Write down the answers to the following questions:

   a) Which planet is the furthest from the Sun? _____ (1)

b) Which planet has a shimmering halo of rings? _____ (1)
c) Circle the correct word: The Sun's rays takes eight years/minutes to reach the Earth. (1)
d) Write down what we call the holes that can be seen on the surface of the Moon, and explain what caused them. (2)

_____

_____

e) Fill in the missing words: The rotation of the Earth makes it appear as if the Sun comes up in the _____, rises higher in the sky and then sets in the_____. (2)

f) Give another name for the outer planets, and explain why they have this name. (2)

_____

_____

g) Explain why scientists were looking for signs that micro-organisms lived on Mars a long time ago. (1)

_____

h) Explain what asteroids are. (2)

_____

_____

i) Explain why the other stars that we see on clear nights look like small shiny dots, and do not appear as large and bright as our Sun. (1)

_____

_____

9. Suggest two reasons why Sutherland and Carnarvon in the Karoo were regarded as suitable sites for the SALT and SKA projects where astronomers explore the universe by using powerful telescopes. (2)

_____

_____

TOTAL MARKS: [50]

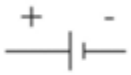
Memorandum: Sample end-of-year examination

Memorandum for sample end-of-year examination

Electricity

1. a) electrical charge
   b) conductors
   c) insulators
   d) non-renewable
   e) renewable
   f) electrical current (6)

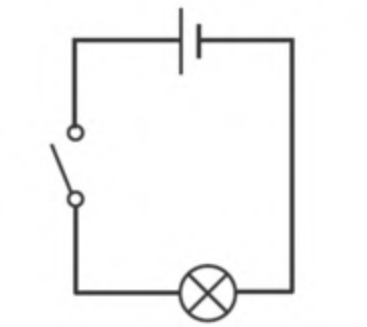
2. Complete the following table by adding the missing words or diagrams. (5)

Component	Symbol
Wire	
Open switch	
Cell	
Closed switch	
Light bulb	

3. Which of the following are conductors and which are insulators? (8)

Object	Conductor	Insulator
Copper wire	X	
Plastic straw		X
Wood		X
Fabric		X
Screw	X	
Coin	X	
Cardboard		X
Key	X	

4. One mark for each component (4)



5. a) Yes (1)
   b) No (1)
   c) When we connect more bulbs in series, the electrical current has to pass through all the different components. If more than one bulb is connected, the light in each one will be dimmer than if there was just one light connected. (2)

Planet Earth and beyond; Systems and control

6. Also accept alternative correct options for changing a word to make each sentence true, e.g. for (f) (6)
   a) The Sun is a source of heat and light energy for all living things on Earth.
   b) The Moon revolves in an orbit around the Earth.
   c) Mars is known as the red planet.
   d) Pluto is a dwarf planet.
   e) The rings of the planet Saturn are made of millions of tiny ice-coated rock fragments.
   f) When the Moon is getting bigger, we say it is waxing. OR When the Moon is getting smaller, we say that it is waning.

7. a) The Moon has no atmosphere, so there is no oxygen on the Moon for people to breathe in. (1)
   b) The Sun heats the Moon's surface to the temperature of boiling water, so they needed special suits to protect and cool them. (1)

8. Write down the answers to the following questions:
   a) Neptune (1)
   b) Saturn (1)
   c) minutes (1)
   d) craters – caused by meteorites and asteroids crashing into the surface (2)
   e) east; west (2)
   f) gas giants – because they are made of gas, no rock, and are large (2)
   g) It would tell them whether there was once life on Mars. (1)
   h) small, rocky objects that occur in belts (groups) throughout our solar system (2)
   i) They are much further away from the Earth than our Sun (which is also a star). (1)

9. There is less pollution than near cities, and the weather in the Karoo is also very dry, so there is often no cloud cover that will make it impossible to see the stars clearly. (2)

TOTAL MARKS: [50]

Section D: Documents

This section is for you to file your copy of the Curriculum and Assessment Policy Statement (CAPS) for Natural Sciences and Technology in the Intermediate Phase.

You may add any other documents you receive in this section and list them below for easy reference.

Grade 6

Study & Master Natural Sciences and Technology

Study & Master Natural Sciences and Technology has been specially developed by an experienced author team to meet all the requirements of the Curriculum and Assessment Policy Statement (CAPS). This new and easy-to-use course not only helps learners master essential content and skills in the subject, but gives them the best possible foundation on which to build their Natural Sciences and Technology knowledge.

The comprehensive Learner's Book:

- provides activities that develop learners' skills and understanding of each of the topics specified by the CAPS curriculum
- includes investigations, practical tasks and enrichment activities for each term
- includes good-quality illustrations, photographs and diagrams in full colour
- offers current and relevant content clearly set out according to the latest CAPS document.

The innovative Teacher's Guide includes:

- expanded contents pages providing a detailed work schedule for the whole year
- guidance on the teaching of each lesson and on each form of assessment
- step-by-step support in the teaching of activities
- photocopiable record sheets and templates, exemplar exams and tests with memoranda, as well as additional worksheets to support your teaching.

David Green obtained an M.Sc. at UWC and a Diploma in Tertiary Education at UNISA. He was Senior Lecturer in Biology and Natural Sciences at Söhnge College of Education until 2003 and is currently Curriculum Advisor for Life Sciences and Natural Sciences in the West Coast Education District (WCED). **Ria de Jager** obtained a Masters Degree in Technology Education. She is Deputy Chief Education Specialist in Technology in KZN, Chairperson of the Technology Association of SA, and has been writing textbooks for 10 years.

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