Living

Geography

TEACHER'S GUIDE

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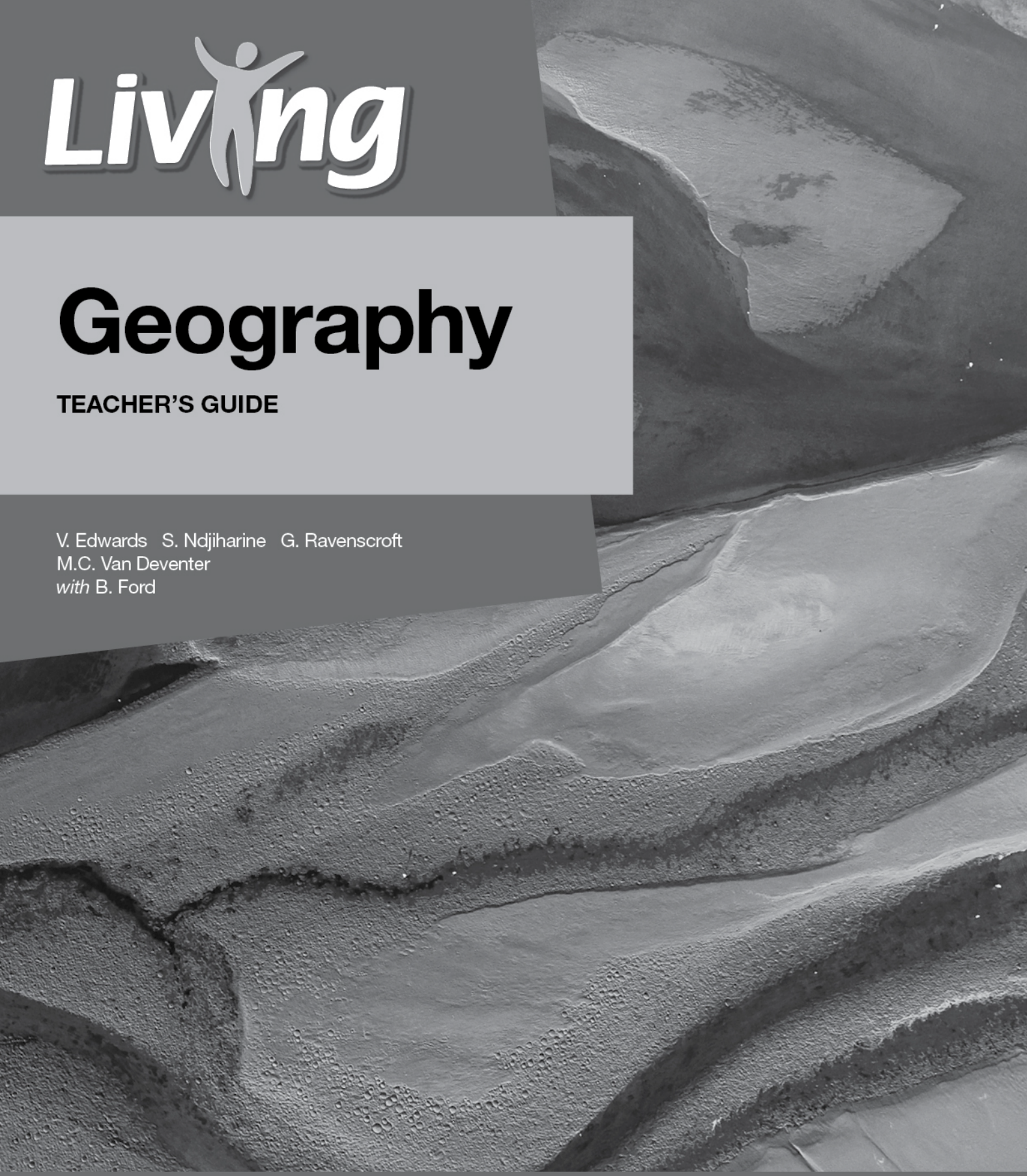

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Contents

How to use this Teacher's Guide

Use this Teacher's Guide with the *Geography Grade 12 Learner's Book*. These components follow the Ministry of Education's Senior Secondary Geography syllabus for Grade 12. This means they are up to date and relevant to current classroom environments and educational needs.

The Teacher's Guide is divided into three sections.

- **Section A** tells you what you need to know about the new curriculum, and how the Learner's Book and Teacher's Guide help you meet the objectives laid out in the syllabus.
- **Section B** contains a suggested year plan and lesson plans that correspond to each theme and topic of the Learner's Book. These lesson plans will help guide you and your learners through the content. It also discusses the different types of assessment used in the Learner's Book and gives a description of the type of questioning that can be expected in a Grade 12 test or examination paper.
- **Section C** contains additional resources that you may find useful.

The lesson plans

Each theme starts with a table that gives you a summary of the syllabus outcomes. The table also outlines any cross-curricular links and accommodations needed for inclusive education, and gives suggested time allocations and resources. This provides a quick overview of the theme, which is useful for planning purposes.

The overview tables are followed by detailed lesson notes, which correspond to the Learner's Book pages. In these notes, you will find:

- suggestions about how to organise each lesson
- suggestions on when individual, pair or group work is appropriate
- applications for suggested resources
- suggestions about which activities can be given as homework
- answers to activities
- suggestions for inclusive education and continuous informal assessment
- remedial and extension activities.

Where possible, this Teacher's Guide will help you with ideas on how you can overcome obstacles to deliver the best possible lessons to your learners.

Section A Teaching Geography in the Senior Secondary Phase

The national curriculum

The national curriculum is based on the democratic principle of an equal opportunity being offered to all. Namibia has a diverse population made up of people of many languages and cultures. They should all receive the same opportunities to learn, develop and prosper in life. The diversity in your class will mean that learners have different learning styles and paces of learning. You may also find that your learners come from very different backgrounds. These factors will affect your planning and lessons.

Geography aims to increase the learners' knowledge and understanding of the relationship between people and their environment. The Geography syllabus for the Senior Secondary Phase helps learners to become responsible citizens in their community, country, continent and the world, through the development of essential knowledge, understanding, skills and attitudes.

A guide to the Geography curriculum

Every subject has its own curriculum and syllabus.

The skills and requisite knowledge are given in the syllabus as well as in this Teacher's Guide, and enable you to check that you are covering the requirements of the subject. The aims of the Geography curriculum (page 2) are to develop and acquire the following skills:

- Knowledge and understanding of the terminology, concepts and systems fundamental to a study of physical and human geography
- A sense of place and an understanding of relative location on a local, regional and global scale
- An awareness of spatial distributions of phenomena on the Earth's surface and the relationships among the dynamic nature of such distributions
- An understanding of the relationships and interactions of people and their environment in response to physical and human processes in Namibia and internationally
- Understanding of the potentialities and limitations of the physical environment for human activities
- A critical awareness of different ways of life to foster positive attitudes towards other people, gender and societies with different social, economic and political circumstances
- A critical awareness of the factors and processes that act upon physical and cultural environmental systems that bring about change
- An understanding of aspects of the contemporary world that are changing
- An awareness of societies that are undergoing rapid social and economic changes
- An understanding how human activities can lead to environmental enhancement and degradation
- An informed attitude towards the environment, including recognition of the need for conservation
- Geographical observation, analysis and communication
- Understanding of HIV and AIDS, gender, information technology and environmental issues, and their impact on development.

In addition, the following skills, as listed on page 1 of the Geography syllabus, are critical to the teaching of Geography, and are infused in the guidelines for teaching in this section:

- Communication skills
- Numeracy skills
- Information skills
- Problem-solving skills
- Self-management and competitive skills
- Social and cooperative skills
- Work and study skills
- Critical and creative-thinking skills.

Teaching time

The Namibia Senior Secondary Certificate Advanced Subsidiary (NSSCAS)-level syllabuses are designed on the assumption that learners have about 180 guided learning hours per subject over the duration of the course (1 year), but this is for guidance only. The number of hours required to gain the qualification may vary according to local conditions and the learners' prior experience of the subject. The National Curriculum for Basic

Education (NCBE) indicates that Geography will be taught for 9 periods of 40 minutes each per 7-day cycle, or 6 periods of 40 minutes each per 5-day cycle, over a year. This allows learners sufficient time to consolidate the theory, practise their skills and apply their Geography knowledge.

Links to other subjects and cross-curricular issues

The topics covered in the Learner's Book and Teacher's Guide link to a number of cross-curricular issues including: Gender Issues, Environmental Learning, HIV and AIDS, Population Education, Education for Human Rights and Democracy (EHRD), Information and Communication Technology (ICT), and Road Safety.

The links to cross-curricular issues are listed in the tables at the start of each theme and discussed in more detail throughout the book.

Geography in action

Teachers play an important role in nurturing a love for Geography. Geography is not just theory – practical activities, tasks and investigations are just as integral a part of the subject. It is important that learners feel enthusiastic and excited when they enter the classroom.

As teachers, it is important that we keep the lessons as learner-centred as possible. It is important that Geography, where possible, is linked to the experiences of learners in Namibia. The more relatable a subject, the easier it is for the learners to make sense of the theory and appreciate the role that Geography plays in our everyday lives.

Allocate as much time as possible to practical Geography tasks. Practical investigations allow learners the opportunity to see Geography as a science in action and to apply their knowledge. It also teaches the learners life skills such as the ability to justify statements, draw conclusions and analyse data.

Geography often has terminology that learners find confusing, so we should always pitch our lessons at the level of the learner. Introduce key words at the start of a topic and ensure that the whole class understands their meaning before moving on. Using language that is above their cognitive level will result in the learners becoming discouraged and losing interest.

Integration with other subjects is essential. Language forms an integral part of the Geography curriculum and should be seen as part of learners' general education, as well as their Geography education. Links should be made throughout the lesson where possible, and collaboration between teachers of different subjects can be a valuable tool in helping the learners achieve success across all facets of their schooling.

Learners who are engaged actively in lessons will learn faster, retain the information better and have a more enjoyable classroom experience.

Your teaching challenges lie in your ability to become familiar, and teach, with the following realities in mind:

- Learner-centred education
- Inclusion in a diverse community
- Supporting learners with varying abilities (multi-ability learning)
- Managing large classes
- Barriers to learning – their challenges and possible solutions to address barriers to learning
- Informal assessment as a positive part of the learning process
- Accurate diagnostic assessment
- Providing or developing resources that meet the requirements of the curriculum

Inclusive and learner-centred education

Geography, in particular, lends itself to the extensive promotion of inclusion. You can use these opportunities to instil in all learners a sense of inclusivity and caring towards others, as well as building the self-esteem of learners with special needs.

Your learners are all different. Learner-centred education meets the challenge of learning by respecting the individual learning needs and learning styles of every learner. For this model to work, create a positive learning environment that guides learners towards their own achievement and success, both in the classroom and in life. To ensure a match between your teaching style and the needs of the learners, focus your attention on the learners' experiences, backgrounds, interests, talents, capabilities and needs. These will determine the way in which you present and explore content, and will have a direct impact on the likelihood of success.

Supporting learners with varying abilities

Learners learn differently, and creating a successful learning experience for each learner often means creating opportunities for different types of learning.

Different types of learning

For example, learners construct knowledge through hearing (talking through a problem to find a solution or different solutions); listening (moving to a rhythm, singing or making music); seeing (looking at or creating visuals); and touching (building or using tactile means to feel their way).

Allow the descriptions given in the syllabus to guide you when choosing your method. Be flexible enough to encourage learners to construct their own meaning and create their own learning. However, always remain the guide, using your year plan and lesson plans as maps with clear objectives, but with various ways of achieving them. Have a planned route that you navigate sensitively, so that the learners reach their destinations successfully in their own ways.

Constantly make decisions about where to stop and what to experience (content/knowledge), visualise possibilities (methodology and lesson delivery), avoid or deal with misconceptions, and make decisions to achieve your goal.

Supporting learners in multi-ability groups

Learners' abilities to manage and achieve the required number of competencies may vary, and it may be useful and practical to group learners into same-ability groups in order to address their needs.

It is crucial that learners receive learning support through adapted teaching approaches, adapted materials, assistance from peers, individual and small-group teaching, extra revision and practice activities, and so on.

A small number of learners have special educational needs to a degree that requires even greater individual attention, additional resources, and specialised assessment opportunities and environments. Others will have impairments that do not necessarily limit cognitive and affective (related to feelings and emotions) learning and development, for example, visual, hearing and physical impairments.

Achievements and the real world

Remember that school education should equip learners for life as adults. It must develop knowledge, skills and attitudes to help them succeed in the increasingly complex and rapidly changing world of information and communication technology.

Use your learners' experience and prior knowledge to build new knowledge and skills.

Gender

Boys and girls sometimes have different ways of seeing and reacting to the world around them. By interacting with one another in a small group situation, they enrich one another's ways of understanding and expressing themselves. Make sure that you structure learning to give boys and girls equal opportunities and treat girls and boys equally. Also make sure that all materials that you use are fair to girls and boys. Be sensitive to pictures that give one gender more attention or focus than the other. Be sensitive to stories or examples that favour one gender over the other.

Managing large classes to support inclusive education

Inclusive education is the right of every learner to participate in and have access to all the educational programmes of mainstream schools. Inclusive education, as well as learner-centred education, in practice, can also be achieved by paying attention and making use of the following strategies.

Classroom organisation

As learners will work alone, in pairs, in groups and as a class, it is useful to have a flexible approach to classroom organisation. Make sure you can move tables and chairs easily and quickly in order to accommodate various teaching and learning strategies.

- Plan where to stand, sit and move. Your use of classroom space is part of your teaching strategy. For some lessons, you might be up front and clearly visible, while for other lessons, learners might take leadership and you will play a facilitative role in the background. When learners present or give feedback to the class, make sure they face the whole class, and can be seen and heard by all.

- It is useful to have a small resource corner where learners can help themselves to items such as recyclable clean waste (for example, used cardboard, tins and plastic bottles) for the various items they need to create. Have enough space in the class for learners to display their posters. If the walls are full, tie a line of wool or string across the classroom as high as possible, so that the learners can hang their posters on the line. This creates an interesting visual display.
- Group and pair the learners quickly and efficiently. While it is sometimes useful to allow learners to choose their own groups, at other times it is best to place them in groups, so that they learn to work in a range of groups and no learners feel rejected. Quick and fun ways to group learners include the following:
  - » Cut strips of scrap paper into various shapes. Place these in a bag or basket and ask learners to pull out one paper without looking. Group all the learners who chose triangles in one group, and so on.
  - » Use scraps of coloured paper to group learners according to the colour they chose.
  - » Ask learners to form a line according to their birthdates. The first five learners in a line form a group, the next five learners form another group, and so on.

Interactive learning

Not all learners learn in the same way. Experienced teachers know instinctively that the old-fashioned chalk-and-talk way benefits only a small number of learners.

By using a variety of teaching methods and presentation modes, Geography teaching will remain fresh and exciting for both you and your learners. It will also accommodate different learning styles.

Engage the learners in the learning process by allowing them to carry out investigations and practical tasks. This gives them confidence with Geography equipment.

The conceptual framework of the Grade 12 curriculum is centred on the learners' abilities to follow instructions. The content is organised in a logical manner, so that future learning experiences build on it.

In the learner-centred classroom, you create the opportunities for learner–teacher and learner–learner interactive learning. In this type of classroom, the different approaches to learning become apparent and guide you to identify what learners need to know, the pace at which they can learn and the support each learner requires.

Observe, listen and watch the levels of interaction, then use your knowledge and skills to guide learners, and build their knowledge, skills, positive attitudes and self-esteem. The greater the learners' self-esteem, the more successful they will become in any situation.

Participation, contribution and production

Participation, contribution and production are vital skills required for a successful and meaningful cooperative learning experience – when learners learn, share learning, engage critically with the subject matter, and support the learning experiences of their peers. When these skills are applied, learning becomes possible, and exciting, and sets the pace and tone for learning in the classroom.

These skills also enable each learner to satisfy their learning needs based on prior knowledge and experience, not only of the subject content, but also the world. In a real way, it shows learners how knowledge and skill are linked to real-life experience since inevitably, real-life experiences are shared in an interactive, engaging environment.

Small group work

The advantage of working with a small group of learners is that you can identify learners with similar prior knowledge or skills who will benefit from this way of teaching. Separate them from the rest of the class for about 15 minutes at a time.

Organise the rest of the class in a structured way, so that they are occupied positively while you are busy with the group needing your attention. For example, learners could do something they have done before, but can now add new information that they have learnt recently. Make sure your instructions are clear and easy to follow, giving you the time and opportunity to work closely with the small group.

Rotating group work

Rotate the types of group work, so that learners are not labelled in any way.

- The group that knows more about a topic and can move forward quickly should be able to do so. This gives you the opportunity to attend to the group needing extra input.

- Create groups with different abilities and needs. Mix the learners from the previous groups, so that there is no stigma attached to working in groups. This technique requires you to know each learner's prior knowledge and skills for whatever they are learning. Informal assessment gives you this knowledge.

Learners guiding learners

Most of the teaching focus is on you as the source of knowledge and skills. Sometimes, learners can be the source of knowledge and skills. A learner who has a family member or close friend with a skill that relates to the content has a great deal to share with their classmates. This builds the learner's confidence and self-esteem, vocabulary and speaking skills. Learners usually enjoy learning from their peers.

Addressing barriers to learning

Inclusive education supports diversity amongst all learners, where diversity is regarded as a strength rather than a setback. This means that we have to remove all barriers to learning. In any class, and especially in larger classes, you will deal with many different learners who come from a wide range of backgrounds and abilities. Understanding these learners and their needs enables you to include their needs in their education in a beneficial way.

Namibia is a democratic society. *Democratic* means that decisions are made taking into account each member's contribution. For learners to become well-functioning adults, they should be accepted for who and what they are at this stage of their lives. Their potential should be recognised and developed to the best of their abilities. Democracy also implies that people are individuals with their own strengths and weaknesses, which may be different to other people's strengths and weaknesses.

Include learners who have barriers to learning or other individual needs in mainstream schools. The education system addresses the needs of learners with barriers to learning by using different teaching methods and materials where needed.

Learning support units, resource units and resource schools provide for learners who are so severely impaired that they cannot benefit from attending inclusive schools. Once they are ready, they can join inclusive schools.

You might find barriers to learning that you cannot deal with in your class. It is important that you assess learners with barriers carefully, understanding their levels of capabilities and whether you can help them. If the learners need special education in smaller groups, you should recommend that. Remedial education specialists and psychologists will recommend the best approach to their education.

If you still have learners with less severe barriers to learning in your class, it is better to extend their learning at a different pace, so that they can reach the same outcomes as the other learners. Their sense of achievement encourages them to reach for further goals. You might have different groups of learners in your class working at different paces and with different learning methods; this makes your approach and positive attitude important.

General tips to assist learners with learning barriers

- Learners who have difficulty organising themselves can be paired with learners who are more organised. These learners can support them by writing down homework and completing work on time.
- Keep an ongoing list of key words and terms, which will help learners become familiar with words often used in Geography.
- Help learners plan their tasks by developing short mind maps that guide the process and help them feel less overwhelmed. Break down tasks into small parts, which will help learners accomplish the task.
- Place learners who battle to concentrate in the front of the class. If you think their minds are wandering, touch their arms gently as you walk around the class, or involve them in the class by asking them questions.
- It helps learners with learning barriers to have a daily structure that they trust and are familiar with. Always be organised and consistent.
- Remember to give instructions clearly and simply.

Appreciation

We give you applause and accolades for teaching Geography at this level, and ensuring that your learners can reach their potential, ready for all possibilities and success! Your work is contributing to the development of our learners, our nation and our beautiful Namibia. Thank you for teaching Geography. We hope you and your learners enjoy the lessons.

Section B Lesson plan, year plan and teaching guidelines

Lesson plan

This Teacher's Guide provides lesson plans that provide one possible way of teaching the content covered in the Learner's Book. The plans are developed to meet the requirements as set out in the Senior Secondary syllabus for Geography.

A lesson does not need to be completed in one 40-minute period and may take more or less time. The division into lessons serves as a guide. Lesson length may vary depending on the strength of your class and your available resources.

You should consult the lesson plans well in advance of teaching a lesson. This will help you properly prepare for lessons, as you may need time to obtain additional resources that will enrich the learning experience. The lesson plans provide you with guidelines on how to teach each theme. They will assist you by providing insights into approaching the lessons, specifically regarding how the work is covered in the Learner's Book.

Theme: The theme within the given syllabus that is being covered, for example, *Physical geography*.	
Syllabus coverage	This gives a reference to the section of the syllabus covered.
General objectives	These are derived from the topic/skill and are the general knowledge, understanding and demonstration of skills on which learners will be assessed.
Specific objectives	These are the detailed and specified content of the syllabus, which learners need to master to achieve the general objectives, and on which they will be assessed.
Cross-curricular issues	Geography provides scientific knowledge about physical, environmental and human processes that form the basis for cross-curricular education. The cross-curricular issues include Gender Issues, Environmental Learning, HIV and AIDS, Population Education, Education for Human Rights and Democracy (EHRD), Information and Communication Technology (ICT), and Road Safety.
Inclusive education	This gives you ideas as to how to accommodate learners with special educational needs by adapting the syllabus to the needs of the learner through differentiation of teaching methods and material.
Teaching time	This tells you how many lessons are needed for each topic in the theme.
Additional resources needed	Useful resources for you to use in these lessons will be listed here. • Human resources: Invite people from various workplaces to both motivate the learners as well as to describe their work. • Collect a bag of waste items such as plastic cooldrink bottles, washed tins, scraps of paper, egg containers, empty toilet roll tubes, used envelopes and a few bottle tops.

Year plan

The summary of the learning content for Geography Grade 12 and suggested year plan template below can be used and photocopied, and the number of weeks and the number of lessons filled in.

	Lessons	LB pages	TG pages
TERM 1: __ weeks			
Theme 1: Physical geography	**__ lessons**	**2–93**	**20–51**
Topic 1.1 Plate tectonics	**__ lessons**	**4–24**	**21–26**
General objectives Show an understanding of regional and global relief patterns as related to plate tectonics **Specific objectives** • Describe the characteristics of tectonic plates and explain their global patterns • Describe and explain the general distribution of young fold mountains, earthquakes and volcanoes in relation to plate margins: Divergent (constructive), conservative and convergent (destructive, collision) • Describe the causes and effects of earthquakes and volcanic eruptions • Describe the main types of intrusions (batholiths, sills and dykes) • Describe the nature and explain the formation of the East African Rift Valley and its influence on relief and drainage • Describe and explain the distribution of major relief elements of the world such as mountain ranges, shields, sedimentary basins, ocean basins, ocean ridges, ocean trenches and volcanic island arcs **Case study** *Candidates must study the advantages and disadvantages of The East African Rift valley to the local inhabitants.*			
Topic 1.2 Processes on slopes	**__ lessons**	**25–34**	**27–29**
General objectives Understand slope processes and their effects **Specific objectives** • Distinguish between weathering and mass movement • Explain how slopes are modified by weathering and mass movement with reference to slow movement (soil creep and solifluction), flow movements (earthflows and mudflows), rapid movements (landslides) and very rapid movements (rockfalls) • Examine the effect of mass movement on people and the natural environment • Examine strategies to reduce mass movement, with reference to pinning, netting, grading and afforestation **Case study** *Candidates must study the impacts of human activity on slopes showing the effect on the stability of slope, and evaluate attempts to reduce.*			
Topic 1.3 River channel processes and landforms	**__ lessons**	**35–56**	**30–35**
General objectives • Understand river erosion, transportation, deposition and sedimentation • Understand river velocity, discharge and patterns of flow • Know landforms associated with river processes • Understand how human activities influence catchment flows, stores and channel flows • Understand the causes and effects of floods			

Specific objectives • Explain the difference between laminar, turbulent and helicoidal flows in a river channel • Explain the processes by which a river erodes its channel with reference to hydraulic action, corrosion, corrasion and attrition • Explain the processes by which a river transports its load with reference to traction, saltation, suspension and solution • Explain where and why deposition and sedimentation take place in a river channel • Explain the difference between meandering and braided river channels • Describe and explain the formation of gorges, rapids, waterfalls, bluffs, river cliffs, point bars/slip-off slopes, floodplains, levees, alluvial fans, deltas • Describe and explain the human impact to catchment flows, stores and channel flows by land-use changes (deforestation, afforestation, urbanisation), abstraction and water storage • Describe the causes and effects of river flooding • Discuss flood management techniques with reference to forecasts and warnings, soft engineering (floodplain and drainage basin management, wetland and riverbank conservation, and river restoration) and hard engineering (dams, river straightening, levees and diversion spillways) **Case study** *Candidates must study a recent river flood event showing the causes of the flood, impact on both people and the environment, and evaluate attempts to reduce the impact of the flood, for example, flood in Zambezi region.*			
Topic 1.4 The drainage basin system	**__ lessons**	**57–64**	**36–40**
General objectives Understand the components of the drainage basin hydrological system **Specific objectives** • Identify and describe the drainage basin as a system with reference to inputs, outputs, store and flows • Describe and explain how the components of the hydrological system vary by climatic region • Describe and explain the origin of groundwater • Describe the concept of water balance and explain the modification of the cycle by people			
Topic 1.5 Rainfall-discharge relationships within drainage basins	**__ lessons**	**65–71**	**41–43**
General objectives • Understand the component of hydrographs • Understand how climate influences hydrographs • Understand how soil textures, rocks, slopes, vegetation and land use influence hydrographs **Specific objectives** • Define a hydrograph • Identify and name the components of hydrograph • Describe how climate influences the shape of hydrographs with reference to types of precipitation and intensity, temperature, evaporation, transpiration, evapotranspiration, antecedent moisture • Explain how porosity and permeability of soil and rock, slopes, vegetation and land use affect the shape of hydrographs			

Topic 1.6 Atmospheric processes	__ lessons	72–89	44–49
General objectives • Understand the vertical structure of the atmosphere • Understand how the atmosphere is heated • Understand human impact on climate **Specific objectives** • Name and describe the vertical structure of the atmosphere with reference to the troposphere, stratosphere, mesosphere and thermosphere • Explain how the atmosphere is heated by insolation, including the effect of cloud cover on the Earth's heat energy budget • Describe and explain the Earth (global) energy budget • Explain local energy budgets in terms of input and output analysis with reference to the daytime and nighttime energy model • Draw a fully labelled diagram to show the daytime/nighttime model of radiation balance • Distinguish between latent and sensible heat transfers • Evaluate climate change and its effects in global and local context • Discuss the impact and effects of human activities in an urban area on climate: Temperature (heat island), humidity, precipitation and winds **Case study** *Candidates must study a named urban area showing the effects of human activity on climate: Temperature (heat island), humidity, precipitation and winds.*			
Revision and self-assessment	**__ lessons**	**90–93**	**49–51**

TERM 2: __ weeks			
THEME 2: Economic activities and the use of resources	**__ lessons**	**94–161**	**52–82**
Topic 2.1 Manufacturing industries	**__ lessons**	**96–111**	**53–58**
General objectives Understand the dynamic nature of manufacturing industries **Specific objectives** • Describe the factors that influence the location of the following manufacturing industries: » Motor vehicle assembly (with reference to assembly plant(s) in South Africa) » High-technology industries » Craft industries • Describe and explain the spatial and structural characteristics of manufacturing industries including the scale of operation: Small-scale (cottage), factory and multinational • Discuss the importance of manufacturing industries to the economy of Namibia • Describe the nature of industrial landscapes and environmental consequences of industrial developments • Describe and explain the social and economic implications of industrial change **Case study** *Candidates must study a manufacturing industry, for example, the craft industry in Okahandja, Namibia.*			
Topic 2.2 Agriculture	**__ lessons**	**112–128**	**59–67**
General objectives Understand different agricultural systems and their social, economic and environmental implications **Specific objectives** • Describe opportunities and constraints to be considered when developing the land for agriculture			

• Identify the physical and human factors that influence decision-making in creating different systems (intensive/extensive) of agriculture • Discuss how different types of agriculture (arable, pastoral and mixed) vary in terms of inputs and outputs • Explain how the following influence different agricultural systems: » Population density » Technology » Transport » Politics and culture » Physical environment • Examine the socio-economic and environmental implications of change in agricultural land use • Assess the methods of increasing agricultural production with reference to low-income countries • Discuss examples of agricultural conservation and land management strategies			
Topic 2.3 Energy and mining	**__ lessons**	**129–144**	**68–71**
General objectives Understand various sources of energy and minerals and their impact on the environment **Specific objectives** • Analyse the data for the world pattern of production and consumption of energy • Describe how the following factors affect the demand and supply of different sources of energy including: » Resource availability » Sustainability » Level of development » Technology » Climate » Income » Pollution • Examine why energy supplies such as hydroelectricity, fuelwood, wind power, solar power, biofuels and geothermal power are increasing in importance • Discuss the environmental impacts of energy production and transport • Assess how the extraction of minerals and production of energy have consequences for both people and the environment **Case study** *Candidates must study solar energy in China, for example, Tengger Desert Park.*			
Topic 2.4 Water	**__ lessons**	**145–157**	**72–77**
General objectives Understand the demand and supply of water, and the socio-economic and environmental impacts of water surpluses and deficits **Specific objectives** • Define what is meant by surplus and deficiency of water • Suggest reasons why there are areas of surplus and deficiency of water • Explain why areas of water supply and areas of water demand are often different • Discuss the problems associated with scarcity of water supply • Describe and explain the social, economic, political and environmental issues associated with water control and sharing projects • Describe the problems related to water sharing and control (health and diseases, salination, pollution, erosion and deposition) **Case study** *Candidates must study the Lesotho Highland Water Project (LHWP).*			
Revision and self-assessment	**__ lessons**	**158–161**	**77–82**

TERM 3: __ weeks			
THEME 3: Human geography	**__ lessons**	**162–231**	**83–107**
Topic 3.1 Population studies	**__ lessons**	**164–188**	**84–91**
General objectives • Understand population dynamics and their social, economic and environmental impact • Understand the influence of population growth in relation to food supply **Specific objectives** • Distinguish between population distribution and density • Describe factors that influence population density and distribution • Define the main components that influence population growth with reference to birth rate, death rate, fertility rate, mortality rate, natural increase, replacement level and migration • Evaluate and appreciate the link between population and development changes in demographic indices over time (for example, life expectancy) • Distinguish between optimum population, underpopulation and overpopulation • Describe and explain the recent rapid increase in the world's population • Discuss the problems associated with the recent rapid increase in the world's population • Demonstrate an understanding of the causes and consequences of overpopulation and underpopulation • Evaluate and appreciate the concepts of overpopulation, optimum population and underpopulation • Identify the unequal distribution of food supplies in relation to population and the problems caused such as quantity of food, famine, malnutrition and adequacy of diet, and suggest possible solutions to these problems **Case study** *Candidates must study one country's population policy regarding natural increase, showing the difficulties faced, and evaluate the attempted solutions.*			
Topic 3.2 Population movements (migration)	**__ lessons**	**189–201**	**92–96**
General objectives Understand the dynamics of population movements **Specific objectives** • Describe population migration (voluntary/involuntary, internal/international) • Discuss the role of constraints, obstacles and barriers associated with migration • Discuss the causes of migration (push and pull factors) • Discuss the processes (for example, step and chain migration) and patterns of migration (for example, age, gender, family structure, economic status) • Describe and explain the geographical implications of population change in areas of population loss and gain **Case study** *Candidates must study one international migration stream: Causes, character, scale, pattern and impacts on source areas and receiving/destination areas.*			
Topic 3.3 Settlement studies	**__ lessons**	**202–227**	**97–104**
General objectives Understand the dynamics of rural and urban settlement and the process of urbanisation **Specific objectives** • Describe and explain the factors that influence the size, development and functions of rural and urban settlements and their sphere of influence • Examine the factors that lead to rural depopulation and suggest possible solutions			

• Discuss the causes and effects of the contrasts in the process of urbanisation in developing countries like Namibia (low-income countries) and high-income countries • Identify and give reasons for the changing size and distribution of world cities • Describe and explain problems related to urbanisation, including urban sprawl, urban decay, pollution and transport • Suggest solutions to urban problems such as urban planning, satellite settlements, site-and-service schemes, transport and new forms of communication • Give reasons for and explain the implications of change within urban areas • Describe and explain the inequalities in living standards that may arise in cities • Identify and describe features of urban change in high-income countries such as counter urbanisation and gentrification **Case study** *Candidates must study urban settlements showing the challenges of, and evaluating the attempted solutions, for each of the following:* • *A shanty town (squatter settlement)* • *Providing infrastructure (either power or transport) for the city.*			
Revision and self-assessment	**__ lessons**	**228–231**	**104–107**

TERM 4: __ weeks			
THEME 4: Interpretation of topographic maps	**__ lessons**	**232–269**	**108–119**
Topic 4.1 Interpretation of topographic maps	**__ lessons**	**234–265**	**109–118**
General objectives Know how to read and interpret various topographic maps **Specific objectives** • Identify the characteristics of a map such as the title, key, scale and direction • Demonstrate the ability to use scale to measure distance, and to calculate area and gradient • Demonstrate the ability to find direction and calculate bearings • Identify landforms on maps using contours and symbols • Describe human activities in relation to the features on a map • Recognise and interpret horizontal and oblique photographs (landforms, natural vegetation, land use and settlement) • Locate features on a map using the latitude and longitude coordinate system • Demonstrate skills of analysis and interpretation as well as basic map-reading skills • Analyse and interpret the physical and human landscape by referring to map evidence such as patterns of relief, drainage, settlement, communications and land use			
Revision and self-assessment	**__ lessons**	**266–269**	**118–119**

Assessment

Types and methods

Continuous assessment

Continuous assessment is process and product assessment. It is you observing and listening carefully and making short notes on either the aspect you are assessing or on something worth noting. The role of continuous assessment is to find what is positive, what has been achieved, to affirm these aspects and to give the learner clear instructions to help them take the next step. Its role is also to discover shortcomings like the lack of some essential knowledge or an inability to perform a skill. In this case, your guidance is needed. You are not required to do the work for the learner.

Guidance means to give enough information and teaching support to empower your learners to do the task themselves.

Suggested continuous assessment activities

Continuous assessment should be planned and programmed at the beginning of the year and kept as simple as possible. In Geography in the Senior Secondary Phase, the continuous assessment tasks could be as follows:

- **Practical investigations:** These assess the learners' ability to think and reason independently and to reflect critically on their own thinking. For example, a statistical experiment or a probability project where the learners have to determine the relative frequency of an occurrence, or determining areas and perimeters of buildings, and so on. These are activities that most teachers already use in their day-to-day teaching. These activities could introduce a topic, be used during the teaching and/or during revision of a topic. They may well include assessment involving competencies to do with locating information, conducting surveys, analysing information or presenting information.
- **Revision:** The assessment exercises at the end of each theme could be used as revision, or as a test to ascertain the learners' knowledge.
- **Written tests:** These are specifically set by the teacher to assess the learners' achievements in relation to competencies specified in the syllabus. Tests should consist of both short questions and more structured questions, as prescribed by the syllabus.

Formative assessment

Formative assessment is assessment *for* learning. It is any assessment made during the school year to improve learning. Thus, all continuous assessment is continuous formative assessment. It should be used to motivate learners and to encourage healthy study habits and creative problem-solving abilities.

Summative assessment

Summative assessment is assessment *of* learning. It is the sum of the learner's achievements during the year, together with the final end-of-course test or examination to give a single end-of-course promotion grade.

Diagnostic assessment

"A learner brings to the school a wealth of knowledge and social experience gained continually from the family, the community, and through interaction with the environment."

Your role is to create opportunities for successful learning by affirming what learners know, giving them opportunities to express themselves, and using their talents and strengths to direct and inform learning. More powerful learning is possible when learners can make connections to what they already know and when it builds on their interests. In this way, you can adapt and modify the curriculum to suit the needs of the learners rather than the learners adapting to the demands of the curriculum.

"Learning in school should thus involve, build on, extend and challenge the learners' prior knowledge and experiences."

Diagnostic assessment is a type of assessment that examines what a learner already knows and can do prior to a new set of content/concepts being introduced, looking back in order to provide valuable feedback to the teacher; and/or to assess whether learning has taken place after a new concept/s has been taught, again looking back in order to provide feedback to the teacher.

Diagnostic assessments are often referred to as *baseline assessments* or *preassessments*. They can be short, simple, and easy to assess and interpret, but must be designed in a manner that is useful and provides the required feedback about a learner's level of understanding and skill.

Diagnostic assessment information may be gathered using:

- short exercises, tests and quizzes
- summative assessments of the previous learning activity.

The Starter activity at the beginning of each topic and the assessment exercises at the end of each theme in the Learner's Book are forms of diagnostic assessment that test whether learners have grasped the knowledge and skills in a previous grade and/or theme.

Assessment is thus integral to learning and teaching. It informs teachers about learners' specific needs and provides teachers with feedback. Teachers can use this feedback to improve their teaching strategies. The learners, on the other hand, can set attainable goals and learn to ask questions if they do not understand the work.

As the teacher, you must do some active reshaping of the learners who make mistakes, because many of your learners may already have internalised negative views about making mistakes at school. Motivate learners to learn from their mistakes and to do better with the next assessment.

Remember that some learners have special educational needs because they encounter barriers to their learning and development. Meaningful assessment serves as a major impulse for further learning. If learners are successful in assessment, they are enthusiastic and try even harder, and with more confidence.

Informal assessment

There is a distinct difference between informal and formal assessment. Informal assessment is noting – with criteria – how each learner is dealing with the learning and with social issues, such as cooperation and negotiation, and then doing something about whatever you discover. You can observe every stage of the process, as long as you know what you are looking for. During the process, there is time and opportunity for questions and answers, and for discussion.

There is also the opportunity for the learners to self-assess or for you to encourage peer assessment. Be alert when asking for peer assessment, because learners need to learn from you how to give feedback that is affirming. You can assist the learner assessors by asking them questions. This takes away the negative possibilities and focuses on positive feedback and assessment.

Informal assessment is to help improve the process. You should assess informally at every stage of the process, noting the learners' experimentation, their learning, their growing confidence and competence.

Formal assessment

The four assessment objectives for Geography are as follows:

A. Knowledge
B. Understanding and application
C. Skills
D. Evaluation and decision-making

The following are descriptions of each of these assessment objectives:

A. Knowledge

Learners should be able to:

A1 give definitions and explanations of relevant geographical terms and concepts
A2 show working knowledge of relevant principles, theories and models
A3 accurately recall the location and character of chosen places and environments
A4 show knowledge of the physical and human processes at work.

B. Understanding and application

Learners should be able to:

B1 understand the complex and interactive nature of physical and human environments
B2 understand how processes bring changes in systems, distributions and environments
B3 recognise the distinctiveness and the generality of places and environments
B4 recognise the significance of spatial scale and of time scale
B5 apply this geographical understanding to new contexts.

C. Skills

Learners should be able to:

C1 interpret a variety of types of geographical data and sources and recognise their limitations
C2 use geographical data to identify trends and patterns
C3 use diagrams, sketches and graphs to illustrate geographical features

C4 demonstrate skills of analysis and synthesis of geographical information
C5 communicate geographical evidence, ideas and arguments.

D. Evaluation and decision-making

Learners should be able to:
D1 assess the effects of geographical processes and change on physical and human environments
D2 evaluate the relative success or failure of initiatives
D3 analyse the viewpoints of different groups of people and identify conflicts of interest
D4 assess the decision-making process in physical and human contexts
D5 recognise a number of possible outcomes from a given situation

Scheme of assessment

All learners take Papers 1 and 2.

Paper 1 (1 hour 45 minutes): 60 marks – Written
The paper will consist of nine questions, three each from the three sections:
- Section A: Physical geography
- Section B: Economic activities and the use of resources
- Section C: Human geography

Learners answer six questions, choosing two from each section. Questions are resource- and skills-based and may cover either a single topic or a combination of related topics.
The weighting of this paper is 37.5%.

Paper 2 (3 hours): 100 marks – Written (Extended writing and map work)
Learners will be required to answer four questions (4 × 25), choosing one question each from Sections A, B and C. Section D will be compulsory and based on a large-scale topographic map (1:50 000) in full colour from any country in the SADC. Questions are structured and give the opportunity for extended writing. Some questions involve the use of stimulus materials.
The weighting of this paper is 62.5%.

Specification grid

The following grid summarises the connection between the assessment objectives and each exam paper:

Assessment Objective	Weighting (%)	Paper 1 Marks	Paper 2 Marks
A	31	18	32
B	31	18	32
C	23	24	12
D	15	–	24
Total	**100%**	**60 marks**	**100 marks**
Total weighting per paper		**37.5**	**62.5**

[Source: NIED, Geography syllabus, Senior Secondary, 2018, pp. 14–15]

Theme 1 Physical geography

Syllabus coverage	See the year plan in Section B (pp. 11–16)
General objectives	**Topic 1.1: Plate tectonics** Show an understanding of regional and global relief patterns as related to plate tectonics **Topic 1.2: Processes on slopes** Understand slope processes and their effects **Topic 1.3: River channel processes and landforms** • Understand river erosion, transportation, deposition and sedimentation • Understand river velocity, discharge and patterns of flow • Know landforms associated with river processes • Understand how human activities influence catchment flows, stores and channel flows • Understand the causes and effects of floods **Topic 1.4: The drainage basin system** Understand the components of the drainage basin hydrological system **Topic 1.5: Rainfall-discharge relationships within drainage basins** • Understand the component of hydrographs • Understand how climate influences hydrographs • Understand how soil textures, rocks, slopes, vegetation and land use influence hydrographs **Topic 1.6: Atmospheric processes** • Understand the vertical structure of the atmosphere • Understand how the atmosphere is heated • Understand human impact on climate
Specific objectives	The specific objectives are listed in the year plan in Section B in this Teacher's Guide and at the beginning of each topic in the Learner's Book.
Cross-curricular issues	• Environmental Learning: Topics 1.1–1.6 • Population Education: Topics 1.1–1.6 • Information and Communication Technology (ICT): Topics 1.1, 1.2, 1.3 and 1.6 • Road Safety: Topic 1.2
Inclusive education	• Learners with visual impairments need assistance with understanding diagrams, maps and photographs. • Learners with hearing impairments need to be accommodated during group work activities and class debates (see tips on page 52).
Suggested teaching time	• Topic 1.1: 19 lessons • Topic 1.2: 10 lessons • Topic 1.3: 20 lessons • Topic 1.4: 8 lessons • Topic 1.5: 7 lessons • Topic 1.6: 17 lessons • Revision and self-assessment: 10 lessons
Additional resources needed	Internet (if available); graph paper; atlases; resource persons

Introduction to this theme

Introduce this theme by explaining to your learners that it covers physical geography. Remind them of the physical geography topics covered in Grades 10 and 11. Your introductory lesson can also include a brief discussion of the different topics they will learn about in this theme. Tell the learners that they already know some of the content that is covered as they learnt about plate tectonics and rivers in Grades 10 and 11.

TOPIC 1.1 Plate tectonics

LB pages 4–24

Beginning these lessons

Prior knowledge: Learners should be able to recall most of the content in this topic. They learnt about the theory of plate tectonics in detail in Grades 10 and 11.

This topic focuses on how plate tectonics have influenced the regional and global patterns of young fold mountains, volcanoes, earthquakes, volcanic intrusions, shields, basins, oceanic ridges, oceanic trenches and volcanic island arcs.

Starter activity

This activity revises the internal structure of the Earth and the theory of plate tectonics. This will help learners to understand and explain how these processes influence regional and global relief patterns.

Learners can work in pairs to complete the activity. Ensure that any learners with visual impairments work with a sighted learner who can describe Figure 1.1.1 in the Learner's Book to them. Afterwards, hold a class discussion so that learners can compare responses.

Suggested answers

1. Learners' sketches should be simplified versions of Figure 1.1.2 in the Learner's Book. The crust, mantle, outer core and inner core should be shown and labelled.
2. The mantle
3. The crust is made up of solid rock materials. It is rigid and very thin in comparison to the other layers.
4. The sial (continental crust) and the sima (oceanic crust)
5. Movement in the mantle causes the thin, solid crust to develop cracks, breaking the crust into pieces called tectonic plates.
6. Convection currents in the mantle
7. **a)** A. Core
   B. Mantle
   C. Convection current
   D. Crust

   b) At E, two tectonic plates are moving away from each another. At F, two tectonic plates are moving towards each another.

Characteristics of tectonic plates and their global patterns

Teaching tips

- Much of what you teach in this topic will be revision. Ask the learners many questions and encourage all learners to attempt answers so that they become confident about engaging with the subject matter. You should be able to move quite quickly when covering this section.
- Using Figures 1.1.2 and 1.1.3 in the Learner's Book, revise the internal structure of the Earth, how convection currents move the plates and how the plates float on the mantle. Remind learners about the characteristics of each layer. Use the analogy of the Earth being like a soft-boiled egg.
- Ask learners to describe and explain the movement of the plates at different types of plate margins. They could sketch the different margins in their exercise books and check these against Figure 1.1.5 in the Learner's Book. Ask learners to write down the different terms used for each type of plate margin.
- Go through the processes that take place at each of the different plate margins. Explain this carefully even if learners have studied this before. Discuss what happens at the upward parts of the convection currents and what happens at the downward parts of the convection currents. Also explain how material is recycled in these areas. Use the diagrams in the Learner's Book to assist you with these explanations.
- Learners could list the different landforms that develop at each plate margin next to their sketches. Remind learners that the movement of the plates creates features on the Earth's surface. It is important that learners associate different landforms on the Earth with the processes of plate tectonics.
- Learners then complete Activity 1 on their own. However, learners with visual impairments will need to work with a sighted learner so that Figure 1.1.11 can be described to them.
- Learners work in pairs for Activity 2.

Homework

Activity 1 can be finished at home, if necessary. As learners work in pairs for Activity 2, they should complete it in class.

Suggested answers

Activity 1 **(LB page 9)**

1. Eastwards
2. Westwards
3. Convergent (destructive)
4. Learners' answers will vary. Examples include the African Plate and the South American Plate; the Australian Plate and the Antarctic Plate
5. **a)** Constructive plate margin
   b) Destructive plate margin
6. The North American Plate and the Pacific Plate on the western side of North America.

Activity 2 **(LB page 9)**

Learners must recognise that the material of the asthenosphere (upper part of the mantle) flows in response to the convection currents that take place in the thick lower mantle. They need to know that the lithosphere (crust) is thin and solid, and has broken into pieces due to movements of the asthenosphere. The pieces of lithosphere therefore float on the asthenosphere and are pulled horizontally across the Earth.

Continuous assessment

Go through the answers to Activities 1 and 2 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Distribution of young fold mountains, earthquakes and volcanoes in relation to plate tectonics

Teaching tips

- Once learners have mastered the knowledge in the previous section, help them apply what they have learnt to deduce the locations of landforms created through tectonic activity. Focus on the relationship between plate margins and the occurrence of fold mountains, volcanoes and earthquakes.
- Divide the class into groups for Activity 3, a general revision activity that checks their understanding of the processes and concepts covered thus far. Ensure that sighted learners help explain the diagrams to learners with visual impairments.

Homework

Activity 3 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in groups.

Suggested answers

Activity 3 **(LB page 11)**

1. **a)** Intercratonic fold mountains
   b) Mid-Oceanic ridge
2. **a)** The Andes Mountains
   b) The Himalaya Mountains
3. The Andes are peripheral fold mountains, which form at convergent plate margins. Compression happens as the oceanic plate and continental plate converge. The oceanic plate subducts beneath the continental plate, which is lifted up and folded to form fold mountains at the edge of the continent.
   The Himalayas are intercratonic fold mountains, which form due to compression caused by the convergence of two continental plates. The plates are both forced upwards and the two continental plates are joined by the folding of the layers of rock.
4. **a)** The African and Eurasian plates are moving away from the North American and South American plates, so this is a divergent plate margin.
   b) Tension forces pull the two plates apart from one another, allowing magma to extrude and create the ridge on the ocean floor.
5. Learners' answers will vary. For example, the Australian and Antarctic plates.
6. New material comes out onto the crust, forming new land as the two plates move apart from one another.
7. These areas experience a lot of volcanic activity and lie in a zone where earthquakes often occur.

Continuous assessment

Go through the answers to Activity 3 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Causes and effects of earthquakes and volcanic eruptions

Teaching tips

- Explain again that plate margins are unstable parts of the crust where earthquakes and volcanoes happen often. Your learners have learnt about these in Grades 10 and 11, so you should only need to revise this with them. Make sure they can define terms such as *focus*, *epicentre*, *seismic activity*, *faults*, *volcanic cones*, and so on. Use the figures in the Learner's Book to illustrate your explanations.
- Ask learners to tell you the effects – good and bad – of earthquakes and volcanoes. List their suggestions on the board. They could then copy these into their exercise books and add others from the Learner's Book.
- Divide the class into groups for Activity 4. Note that Question 4 involves a debate. Make sure learners with hearing impairments are accommodated.

Homework

Activity 4 can be finished at home, if necessary, except for the debate in Question 4. Ideally, learners should complete the whole activity in class, as they are working in groups.

Suggested answers

Activity 4 **(LB pages 13–14)**

1. The point on the Earth's surface immediately above the focus where the earthquake begun.
2. Learners' answers will vary. Any two of the following: Volcanic bombs, tuff, scoria, pumice, small stones
3. Learners' answers will vary. For example, one human impact is that people are injured by falling buildings; one economic impact is that many buildings are ruined and need to be rebuilt, and one environmental impact is that landscapes are damaged by landslides.
4. **a)** Learners should mention both the positives and negatives of living near a volcano.
   b) Learners' summaries will vary. If they would choose to settle near a volcano, their summary must mention that the positives outweigh the negatives, and vice versa if they decide not to settle near a volcano.
5. **a)** The 2018 eruption of Anak Krakatoa in Indonesia
   b) A tsunami is a series of waves in the ocean that have enormous energy and momentum. These happen when there is a disturbance of the sea floor that causes a disturbance in the water.
   c) Both earthquakes and volcanoes at sea can disturb a large amount of water.

d)

Area	Volcanoes	Plate margins	Plate movement
Italy	Mount Etna, Stromboli	Convergent/ destructive	African Plate and Eurasian Plate are converging
Indonesia	Mount Sinabung, Mount Kelud, Anak Krakatoa	Convergent/ destructive	Australian Plate and Eurasian Plate are converging
Japan	Mount Ontake	Convergent/ destructive	Philippine Plate and Eurasian Plate are converging
Chile	Mount Calbuco	Convergent/ destructive	Nazca Plate and South America Plate are converging
Guatemala	Volcán de Fuego	Convergent/ destructive	Caribbean Plate and Cocos Plate are converging
Papa New Guinea	Ulawun	Convergent/ destructive	Australian Plate and Pacific Plate are converging

Continuous assessment

Go through the answers to Activity 4 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Main types of magma intrusions

Teaching tips

- The information in this section links up with volcanism. Go through the content carefully as this is new information for your learners. Explain that magma from the mantle that enters the lithosphere does not always come out onto the Earth's surface (extrusion as lava). Tell learners that the magma oozes (intrudes) into cracks in the crust, where it cools and becomes solid rock. The shape of the intrusion depends largely on the nature of the crack it has intruded into and on how runny the magma is. To demonstrate a sill, you can slip a piece of paper or a thinner book horizontally between two thicker books. Then, hold the books (with the thinner book/paper between them) perpendicular to a horizontal surface and show how this represents a dyke. Use similar simple demonstrations to illustrate batholiths, lopoliths and laccoliths.
- Learners must know that, because it is cooled magma that solidifies in the cracks, it is igneous rock that is formed. Learners also need to know that coarse-grained rock, such as granite, is formed when magma cools deep in the crust, for example, as a batholith, as the magma cooled slowly. However, if the magma intrudes closer to the surface of the Earth, it cools more quickly and a finer-grained rock, such as dolerite, is formed. Use Figure 1.1.17 in the Learner's Book to help learners differentiate between the different intrusions.
- Discuss the different landforms that are found on the Earth's surface when the overlying rocks are removed. The Figures 1.1.18 and 1.1.19 photographs in the Learner's Book will be of assistance.
- Learners then complete Activity 5 on their own.

Homework

Activity 5 can be finished at home, if necessary.

Suggested answers

Activity 5 **(LB page 16)**

1. Extrusive volcanism is when magma comes out onto the Earth's surface as lava. Intrusive volcanism is when magma flows into cracks or between planes in the rock layers. It does not come out onto the Earth's surface.

2. **a)** Magma **b)** Lava
c) Dyke **d)** Sill

3. **a)** Granite dome
b) Long, narrow ridge if the igneous rock is more resistant than the surrounding rock, and a portal if the igneous rock is less resistant
c) Mesa, butte

Continuous assessment

Go through the answers to Activity 5 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Nature and formation of the East African Rift valley and its influence on relief and drainage

Teaching tips

- Ask learners what they know about the East African Rift valley – where it is, what landforms there are, what the environment and climate is like, what flora and fauna are found there, and so on. Perhaps they have heard about or visited one of the area's numerous game reserves, lakes or volcanic mountains such as Mount Kilimanjaro. Stimulate their interest by telling them a little about the Rift Valley.
- Relate the formation of the valley to plate tectonics and then explain in more detail how the valley developed. Figures 1.1.20 to 1.1.22 in the Learner's Book will help you illustrate the concepts.
- Discuss the influence of the Rift Valley on relief and drainage in the area. Use Figure 1.1.23 in the Learner's Book, as well as additional maps in an atlas, if necessary. Ask learners to identify and name the various mountains, lakes and rivers.
- At this stage, learners can complete Activity 6 in pairs. This activity allows learners to engage with the map. Ensure that learners with visual impairments work with learners who can assist them.
- Go through the East African Rift Valley case study and discuss the advantages and disadvantages of the valley for the local inhabitants. Use question-and-answer methodology and see what the learners come up with before you read through the content in the Learner's Book.

- Learners complete Question 1 of Activity 7 on their own. Question 2 is a research activity where they work in pairs. Allow them to do this in class if they do not have research facilities at home.

Suggested answers

Activity 6 (LB page 17)

1. Malawi, Tanzania, Kenya, Uganda, Ethiopia, Mozambique, the DRC, Rwanda, Burundi, Eritrea, Somalia and Zambia
2. Learners' answers will vary. Any four of the following or other suitable answer: Lake Edward, Lake Tanganyika, Lake Malawi/Nyasa, Lake Albert, Lake Rukwa, Lake Kivu, Lake Turkana (*not* Lake Victoria)
3. Lake Victoria
4. The Shire River
5. The Albert Nile River
6. Lake Kivu and Lake Tanganyika are part of the Congo River drainage basin and Lake Edward, Lake Albert, Lake Kyoga, Lake Victoria and Lake Tana are part of the Nile River drainage basin.
7. Virunga Mountains
8. Learners' answers will vary. For example, Mount Nyamulagira and Mount Nyiragongo are part of the Western Rift, while Mount Kilimanjaro and Mt Kenya are part of the Eastern Rift.
9. Learners' answers will vary. Any two of the following or other suitable answer: Rwenzori Range, Mitumba Mountains, Muchinga Mountains
10. Divergent/constructive
11. Tension
12. Learners' sketches should be simplified versions of Figure 1.1.22 in the Learner's Book. The correct arrows should be included, and the rift valleys and block mountains should be labelled.

Homework

Learners work in pairs for Activity 6, so ideally it should be completed in class, but can be finished individually at home, if necessary. Learners can do Question 1 of Activity 7 for homework, as it is an individual activity.

Suggested answers

Activity 7 (LB page 19)

1. Learners paragraphs must mention these facts:
   - » Tourism brings in money and provides jobs.
   - » Fishing in the lakes provides people with food and an income.
   - » Inland waterways allow the transport of people and goods on Lakes Victoria, Tanganyika and Malawi.
   - » When crater lakes dry up, salt deposits are left behind and these are mined.
   - » Soda ash is extracted and mined, and is one of Kenya's main mineral exports.
2. See below for a rubric you can use to mark learners' research projects.

Continuous assessment

Go through the answers to Activity 6 and the main points required for Question 1 of Activity 7 as a class. Learners can mark their own work. Mark their research and report for Question 2 of Activity 7 using a rubric similar to the one below. You could record their marks for continuous assessment.

Rubric: Research project (40)

Introduction	1	2	3	4	5
Fulfilment of requirements	1	2	3	4	5
Presentation	1	2	3	4	5
Factual content	2	4	6	8	10
Conclusion	1	2	3	4	5
Overall impression	1	2	3	4	5
Referencing	1	2	3	4	5

Distribution of major relief elements of the world

Teaching tips

- Discuss and explain the main relief elements of the world with regard to their distribution and formation. At all times, refer learners to the maps and diagrams in the Learner's Book. They must recognise the relationship between relief

elements and the location of plate boundaries, for example, a shield (also called a craton) is a stable area in the centre of a tectonic plate.
- Learners work through of Activity 8 on their own.

Homework

Activity 8 can be finished at home, if necessary.

Suggested answers

Activity 8 (LB page 24)

1. An active continental margin is one that is on the border of a continental tectonic plate. This means that the margin is either converging with or moving past another tectonic plate (usually an oceanic plate). A passive continental margin is one that does not lie on the border of a tectonic plate and so no tectonic activity takes place on that margin.
2. Fold mountains, oceanic trench
3. Both fold mountains and oceanic trenches form at convergent margins. Compression forces the plates together, and the land mass is lifted and folded to form fold mountains. A trench forms in the ocean, as the heavier rock material of the oceanic plate subducts into the mantle.
4. The Mid-Atlantic Ridge, a mid-oceanic ridge
5. Mid-oceanic ridges form at divergent plate margins. Tension pulls two to plates apart and magma rises onto the sea floor and builds up a ridge.
6. Large shield areas would be found on the north-eastern side of North America and South America, Sweden and Finland, western Australia, India, Central Asia, Greenland and parts of Sub-Saharan Africa.

Continuous assessment

Go through the answers to Activity 8 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Remedial and extension activities

Remedial

1. Learners must sketch simple diagrams to show the direction of plate movement at the following plate margins:
   a) Divergent
   b) Convergent
   c) Conservative
2. Learners must sketch a simple diagram to show a batholith, sill and dyke.

Suggested answers

1. Learners' diagrams should match those on page 7 of the Learner's Book. The correct arrows should be included.
2. Learners' diagrams should be simplified versions of the one on page 15 of the Learner's Book. The batholith, sill and dyke should be labelled.

Extension

Divide learners into groups of four. Learners in each group must discuss and explain how the following scientific evidence proves that the continents have moved, and how the evidence relates to the theory of plate tectonics. Each group then reports back to the class.
- The oldest rock formations on the continents formed more than 4 billion years ago, but most rocks of the ocean floors are less than 200 million years old.
- The rocks of the ocean floors close to the mid-oceanic ridges are younger than the rocks close to the trenches.
- Coal, which forms in tropical climates, has been found in regions that do not have a tropical climate.
- Rock layers of similar composition and age are found on either side of the Atlantic Ocean.

Suggested answers

- The rocks of the ocean floors are younger, as new rock is formed at the mid-oceanic ridges and older rock is destroyed at the subduction zones. Continental rocks are not destroyed.
- New rock forms at the mid-oceanic ridges when magma rises to the surface and cools to become solid rock. As the plates diverge at a ridge, this solid rock moves away from the ridge and newer rock is created.
- The coal formed when the plate on which it is found was positioned closer to the tropics, but the plate has now moved to a region where the climate is colder.
- The rock layers formed together at the same time when the African and American plates were joined together, but the plates have since moved away from one another.

TOPIC 1.2 Processes on slopes

LB pages 25–34

Beginning these lessons

Prior knowledge: Learners should be able to recognise different types of slopes from interpreting contours on a topographical map. The difference between weathering, mass movement and erosion was discussed briefly in Grades 10 and 11.

This topic looks at the processes that operate on slopes and how these modify slopes. Learners also study the effects of slope processes on people and the natural environment, and examine strategies to reduce mass movements on slopes.

Starter activity

This activity checks that learners can recognise different types of slopes and can identify the most appropriate uses for certain slopes.

Learners can work in pairs to complete the activity. Ensure that any learners with visual impairments work with a sighted learner, so that the different slopes in Figure 1.2.1 can be described to them. Afterwards, hold a class discussion, so that learners can compare responses.

Suggested answers

1. A. Steep uniform slope
   B. Gentle uniform slope
   C. Steep convex slope
   D. Gentle concave slope
   E. Steep concave slope
   F. Gentle concave slope
   G. Terraced slope
2. Slopes that are not too steep are best for settlement as it is easier to build on gentle, even slopes. There is less likelihood of erosion or collapse taking place.
3. Very steep slopes are unsuitable for roads, especially straight up the slope, as the gradient is too steep for vehicles. When constructing a road in a mountainous area, the road should be built following the contours and not straight up the slope.
4. People farm on slopes but they make use of contour ploughing. If slopes are steep, it is better to practise livestock farming and use the slopes for grazing. Steeper slopes may also be used for plantations. Slopes are used for recreational activities, such as skiing in cold areas, mountain biking, climbing and hiking. Resorts may be constructed, so that visitors can enjoy beautiful views.

Difference between weathering and mass movement; Modification of slopes by weathering and mass movement

Teaching tips

- You should just need to revise the definitions of weathering and mass movement, as this was covered in Grades 10 and 11. Question the learners about weathering and check if they remember the different types of weathering. Define and discuss mass movement, and explain that it can be referred to as *slope failure* – they might not have heard this phrase before. Encourage all learners to attempt answers, so that they become confident about engaging with the subject matter.
- Inform the learners that mass movement modifies a slope, as the shape of the slope is changed.
- Once you are confident that learners remember the difference between weathering and mass movement, move on to describing the different forms of mass movement. Refer to the diagrams and photographs in the Learner's Book to help explain each type of mass movement.
- Learners then work through Activity 1 in pairs. Ensure that any learners with visual impairments work with a sighted learner who can describe the Figure 1.1.12 diagrams to them.

Homework

Activity 1 can be finished at home, if necessary. Ideally, learners should complete it in class as they are working in pairs.

Suggested answers

Activity 1 **(LB page 30)**

1. Mudflow, earthflow, solifluction
2. Mudflow
3. Rockfall, soil creep
4. Rockfall
5. Soil creep

6. Solifluction
7. Rockfall, landslide, mudflow
8. Rockfall
9. **a)** Small steps called terracettes develop on the slope.
   b) Flow marks and small lobes develop on the slope.
   c) A step develops on the slope and a curved scar appears on the landscape.
   d) A large scar is left on the slope as a large portion of it has collapsed.
   e) Rocks falling from the cliff cause the cliff to retreat, and result in the formation of a scree slope at the base of the cliff.
10. Learners' answers will vary. Accept any suitable answer, for example, a landslide as people and homes can be buried.
11. Weathering is the breaking up of rock by the weather elements or by biological and chemical agents. The broken pieces are not moved and remain in their original position. Mass movement is when gravity causes broken rock to move down a slope.

Continuous assessment

Go through the answers to Activity 1 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Effect of mass movement on people and the natural environment; Stategies to reduce mass movement

Teaching tips

- Draw two columns on the board, one with the heading "Effect on people" and the other with the heading "Effect on the environment". Ask learners to suggest what you should write down under each column. Then, explain these effects in more detail.
- Before you begin discussing the strategies to prevent mass movement, explain why mass movements happen. Tell the learners that authorities need to know which slopes are prone to mass movements, so that they can develop strategies to prevent them from happening. Explain the concept of the *shear strength* of a slope.
- Use the images in the Learner's Book to explain the strategies used to prevent mass movements. Ask learners if any of them have seen any of these strategies in reality and encourage them to describe them to the rest of the class. Also use this opportunity to bring in the cross-curricular issue of ICT, which can be used to monitor slope movements.
- Divide the class into groups to complete Activity 2. Ensure that sighted learners help explain Figure 1.2.17 to learners with visual impairments.
- Discuss the different types of mass movements that threaten the road in the case study and the different measures taken to mitigate the danger.
- Learners then work through Activity 3.

Homework

Activities 2 and 3 can be finished at home, if necessary. Ideally, learners should complete them in class, as they are working in groups.

Suggested answers

Activity 2 **(LB page 33)**

1. Learners' answers will vary. Accept any suitable answers, for example:

Cause of mass movement	Strategy to prevent mass
Cutting into the mountain to construct a road	The slopes alongside the road should be covered with concrete or wire netting.
Planting crops on the side of a hill	The sides of the hill should be terraced or, if the slope is not too steep, contour ploughing should take place.
Dumping of pebbles and sand when removing coal from an open-pit mine	Vegetation should be planted at the dump, so that the roots hold the pebbles and sand.
Construction of a tourist lodge in the mountains	Vegetation must be replanted after construction has taken place. Drainage pipes can be constructed into the slope to drain away groundwater.

2. **a)** Constructing the road has undercut the slope. Water entering through the sandstone fractures will saturate the clay, allowing blocks of sandstone to loosen along the vertical fractures and slide on the clay.
   b) Landslide
3. Learners' answers will vary. Accept any suitable answer, for example:
   People often build informal settlements on the slope near a river or even on the unstable banks of a river. Their homes add weight to a slope that is already unstable. Vegetation is cleared to construct the houses. Their homes are not very strong, and will collapse under even small mass movements. Often, the area on a steep slope is the only space available to them to build a house.

Activity 3 **(LB page 34)**

1. Cuttings have been made into the slope so that there are level areas for the road.
2. This road allows people to get from one side of Chapman's Peak to the other side without taking a much longer route. The road is also a tourist attraction, as it allows people to view the steep slopes leading down to the Atlantic Ocean.
3. The road is prone to mass movements such as rockfalls. It has also disturbed the habitat of small animals and caused damage to the environment. Cars using the road also pollute the environment.
4. Strong catch fences catch falling rocks; concrete canopies over the road intercept falling rocks and mudslides; cuttings were concreted over; cameras, message signs, traffic detectors and weather monitoring in the area mean that people can be warned and the road can be closed if there is danger of mass movement/wasting taking place.

Continuous assessment

Go through the answers to Activities 2 and 3 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Remedial and extension activities

Remedial

Learners can copy and complete the table below.

Type of mass movement	Speed of movement	Amount of water present	Steepness of slope
Soil creep			
Solifluction			
Earthflow			
Mudflow			
Landslide			
Rockfall			

Suggested answers

Type of mass movement	Speed of movement	Amount of water present	Steepness of slope
Soil creep	Slow	Happens without water	Gradual
Solifluction	Slow	A little water from frozen soil that has melted	Gradual
Earthflow	Fairly fast	Some water	Steep
Mudflow	Faster than earthflow	More water (like a river of mud)	Fairly steep
Landslide	Fast	Usually a lot of water	Steep
Rockfall	Very fast	Happens without water	Very steep

Extension

Learners can take photographs or make sketches in the area in which they live to show the following:

1. A slope that does not have a strategy to prevent downward movement of weathered material, and where soil erosion/movement is evident.
2. A slope that has mass movement reduction measures in place.

Each photograph must be accompanied by an explanation.

TOPIC 1.3 River channel processes and landforms

LB pages 35–56

Beginning these lessons

Prior knowledge: Learners should be able to remember what they learnt about drainage basins and river systems in Grades 10 and 11, during which river processes and landforms and the use of drainage basins by people were discussed.

Topic 1.3 focuses on the processes that take place in river channels and the landforms created by these processes. Learners also look at how people influence catchment flows, stores and channel flows. Flooding causes, effects and management techniques are covered as well. You should be able to move quite quickly when covering this section.

Starter activity

This activity checks how much learners remember about drainage basins, river courses and components of a river system. They learnt about these in Grades 10 and 11.

Learners can work in pairs to complete the activity. Ensure that any learners with visual impairments work with a sighted learner, so that Figure 1.3.1 can be described to them. Afterwards, hold a class discussion, so that learners can compare responses.

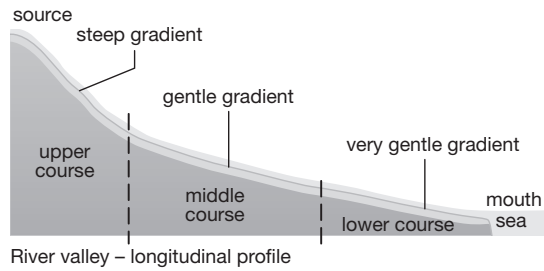
Suggested answers

1. A. Watershed
B. River source
C. Tributaries
D. Confluence
E. River mouth
F. Delta

2. Area of land in which a river system flows and from which a river system gets its water.

3. **a)** Small river that flows down a steep gradient and has a narrow, steep-sided valley
b) Larger river that flows down a gentler gradient and has a more open V-shaped valley
c) Large river that flows down a very gentle gradient and has a wide, flat floodplain

4.



River valley – longitudinal profile

River velocity, discharge and patterns of flow

Teaching tips

- Much of what you teach in this topic will be revision. Use question-and-answer methodology and encourage all learners to attempt answers, so that they become confident with the subject matter.
- Ensure that learners understand the term *velocity* and the factors that influence river velocity. List these factors on the board. Make sure that learners also know the meanings of geographic terms such as *wetted perimeter*. Use the river channel diagrams in the Learner's Book to assist your explanations.
- Stress that a river's discharge is not just the amount of water in the channel, but also how fast it is flowing.
- When discussing patterns of flow, explain helicoidal flow thoroughly, as learners will not have heard of this term before.
- Learners then work through Activity 1 on their own.

Homework

Activity 1 can be finished at home, if necessary.

Suggested answers

Activity 1 **(LB page 38)**

1. The speed at which water flows in a river channel.

2. The river velocity would increase.

3. **a)** Steep
b) Energy
c) Higher
d) Higher
e) Higher

f) Large
g) Large
h) Little

4. Laminar flow is when the water flows in smooth, even sheets. It usually occurs in a river channel that has a smooth, even bed. Turbulent flow is when the water flows in a bubbling motion, continually changing levels. It usually occurs in a river channel that is uneven. Helicoidal flow is when there is a "corkscrew" motion in the current within a meander.

Continuous assessment

Go through the answers to Activity 1 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

River erosion, transportation, deposition and sedimentation

Teaching tips

- Draw a table on the board summarising how a river's energy relates to its gradient, channel characteristics, volume and load, for example:

	High energy	Low energy
Gradient	Steep	Gentle
Channel	Deep, narrow Smooth, even	Wide, shallow Rough, uneven
Volume	Large	Small
Load	Small	Large

- Point out how the above factors affect the amount of energy the river has as you discuss the processes of erosion, transportation, sedimentation and deposition. It might be necessary to recap what you discussed in the previous section.
- Explain vertical, lateral and headward erosion and the processes of erosion. Ask learners questions about the processes of erosion. They should remember these from Grades 10 and 11.
- Tackle processes of transportation in a similar way.
- Stress that deposition takes place when a river's energy declines and its capacity to carry its load is decreased. Explain the factors that cause a river to lose energy as given in Table 1.3.3 in the Learner's Book. Ask learners to suggest where in a river's course sedimentation and deposition is likely to take place.
- Some learners may find it easier to understand how river processes are related to the energy of the river, if you use the following simple analogy: Our energy to perform certain tasks depends on how much food we have eaten, how much sleep we have had, and so on.
- Learners then complete Activity 2 in pairs.

Homework

Activity 2 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 2 **(LB page 42)**

1. **a)** The amount of load that the river can transport in relation to the river's velocity and volume
b) Transportation process whereby heavy, larger rocks are rolled, pushed or bumped along the riverbed
c) The process whereby soil particles that have been eroded and transported by the river settle to the bottom of the river
d) Erosion process whereby acids in the water cause the rock that makes up the channel to dissolve

2. Silt particles are more difficult to erode as they adhere to one another and to the sides and bed of a river channel, creating a smooth surface. Sand particles are larger and heavier, but do not stick together.

3. Abrasion, as the particles carried in the water scratch and scrape against the bed and sides of the channel, loosening the particles, which are then picked up by the flowing water. Hydraulic action can also cause these particles to be eroded from the river channel, as the force of the water loosens them and they are picked up by the flowing water.

4. **a)** Large stones and rocks are transported by traction and saltation.
b) Very small particles are transported in suspension.

5. Gradient gives the river potential energy. A river flowing down a steep gradient has a lot of energy. It flows quickly if it has a large volume and there is little friction, resulting in more erosion and transportation and less deposition. A river flowing down a gentle

gradient has little energy and flows slowly, resulting in less erosion and transportation and more deposition.

6. Floods in a deep, narrow channel increase the amount of erosion, as there is a greater volume of water in the channel and therefore less friction. Floods in a wide, shallow channel cause water to flow over the flat floodplain. The amount of friction is increased, and, as the river has less energy, deposition takes place.

Continuous assessment

Go through the answers to Activity 2 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Landforms associated with river processes

Teaching tips

- Learners enjoy learning about fluvial landforms. Define the term *fluvial* as they may not have heard it before. As you describe each landform and its formation, ensure that learners study the photographs and diagrams in the Learner's Book. Your descriptions must be clear and simple to allow learners with visual impairments to understand each of the landforms. Try to source large pictures that you can put on the classroom walls.
- Make sure that learners can differentiate between a meandering river channel and braided river a channel. Remember to discuss where erosion takes place and why, and also where deposition takes place and why. Learners must be able to sketch a cross section of a river meander.
- Learners work through Activity 3 on their own. However, learners with visual impairments will need to work with a sighted learner who can describe Figure 1.3.22 to them.
- Describe and explain landforms created by erosion. Make sure that learners can recreate the diagrams in the Learner's Book.
- Learners complete Activity 4 in pairs. Ensure that any learners with visual impairments work with a sighted learner who can describe Figure 1.3.29 to them.
- Describe and explain landforms created by deposition. Learners should be able to sketch the diagrams in the Learner's Book.
- Learners then work through Activity 5 in groups. Ensure that sighted learners help explain Figure 1.3.40 to learners with visual impairments.

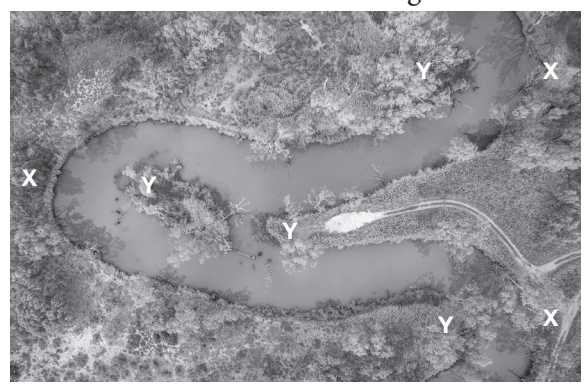
Homework

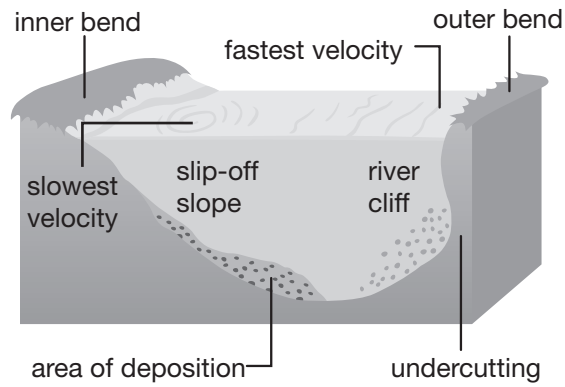
Activity 3 can be finished at home, if necessary. Learners should complete Activities 4 and 5 in class, as they are not working alone for these activities.

Suggested answers

Activity 3 **(LB page 44)**

1. Meandering
2. Learners will sketch the following:

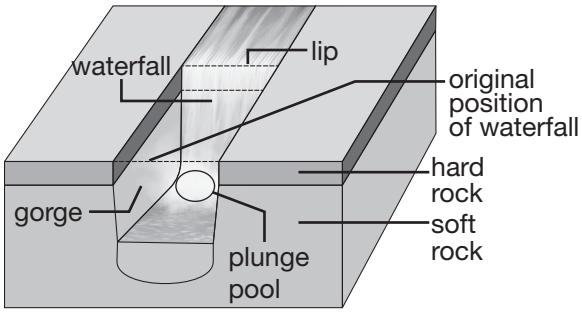


3. 

4. A meandering river channel bends and winds across the floodplain. The large bends that the channel makes are called meanders. Deposition takes place on the inner bend and erosion on the outer bend. A braided channel forms in a shallow river that is carrying a lot of sediment and flowing slowly. The river splits to flow around the islands of alluvium that have been deposited on the bed.
5. Discharge varies more in a meandering channel, as there are areas where the river is flowing quickly and areas where the river is flowing slowly. In a braided channel, the flow is consistently slow.

Activity 4 **(LB page 46)**

1.



2. Vertical and headward erosion

3. Rapids are a series of little waterfalls that occur when there is a sudden change in gradient that is not too steep, caused by a dipping layer of resistant rock. A waterfall forms where there is a large change in gradient caused by a layer of resistant rock across the course of the river.

Activity 5 **(LB page 49)**

1. **a)** There are bare, sandy areas and vegetation is sparse.
b) Meanders, meander scars, flat and wide valley floor, deposition (braided river)
c) The landscape is flat.
d) The road could be covered with water when there are floods and the river overflows onto the floodplain.

2. It is flat and the soil is fertile due to the deposition of alluvium. (Water is also easily accessible.)

3. An alluvial fan develops as a river descends a mountain and flows onto land with a gentler gradient. This causes the river to lose energy and it therefore deposits material at the base of the mountain. A delta forms when a river slows down, as it flows into a sea, ocean or large lake. The river also loses energy and deposits material.

4. Erosional landforms are found mainly in the upper course, as this is where there is a steep gradient and the river has more potential energy. In the middle and lower course, the river has less potential energy, as the gradient is gentler and the river is also carrying a large load.

Continuous assessment

Go through the answers to Activities 3, 4 and 5 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Impact of human activities on catchment flows, stores and channel flows

Teaching tips

- Learners should have accumulated sufficient knowledge of water and water issues for you to be able to hold a discussion on the importance of water, uses of water and the effects of human activities on water supplies. Guide their discussion, so that they link these issues to the impact on catchments flows, stores and channel flows. Take measures to ensure that learners with hearing impairments are able to participate in the discussion.

Homework

Activity 6 can be finished at home, but should ideally be completed in class, as it is a group activity.

Suggested answers

Activity 6 **(LB page 52)**

1. Learners' answers will vary. Accept any suitable answers, for example:

Change to land surface	Quality of water flowing in a river	Volume and flow of water in a river channel
1. Deforestation	More silt in water	Greater volume and flow as less infiltration and more runoff
2. Arable farming	Fertilisers in water, leading to eutrophication	Reduced volume and flow due to abstraction
3. Construction and impermeable surfaces	Pollutants such as oil/ petrol in water	Greater volume and flow as less infiltration and more runoff

2. Learners' answers will vary. Accept any suitable answers, for example:
Deforestation causes increased runoff in the catchment area and removal of sand and soil. Farmers might use fertilisers. Rainwater runoff over the surface will then contain fertiliser, increasing nutrients in the water and possibly causing eutrophication.

Impermeable surfaces such as tar and concrete reduce infiltration, creating greater runoff. Runoff might also be polluted.

3. People reduce water stores underground and in rivers by building dams and abstracting water for use. Constructing impermeable surfaces also decreases infiltration rates, so less water seeps into the ground and groundwater stores are reduced.

Continuous assessment

Go through the answers to Activity 6 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Causes and effects of floods

Teaching tips

- Describe and explain the causes of flooding to the learners. List these in two columns on the board, under "Physical causes" and "Human causes". Ask learners for their ideas before going through the content in the Learner's Book.
- Discuss the effects of flooding, getting input from the learners. You could ask learners if any of them has experienced a flood and, if they have, ask them to describe how they and their families were affected. Be sensitive to learners who may have lost loved ones or property to a flood event. Alternatively, some learners may have read or heard about a flood event somewhere.
- Learners then complete Activity 7 in groups. Ensure that sighted learners help explain Figure 1.3.44 to learners with visual impairments.
- Explain the difference between hard engineering and soft engineering techniques.
- Learners then take on Activity 8 in pairs. Ensure that any learners with visual impairments work with a sighted learner who can describe Figure 1.3.45 to them.
- Go through the case study and explain why forecasts and warnings are important in helping to prevent loss of lives during a flood event. Use this opportunity to bring in the cross-curricular issue of ICT and its use in flood management.
- Learners then work through Activity 9 in pairs.

Homework

Activities 7, 8 and 9 can be finished at home, if necessary. Ideally, they should be completed in class, as they are not individual activities.

Suggested answers

Activity 7 **(LB page 54)**

Learners' answers will vary. Accept any suitable answers, for example:

Factor	How this leads to flooding	Human/ physical factor
Clearing of catchment vegetation	More runoff of rain into the river	Human
Overgrazing	More runoff of rain into the river	Human
Steep slopes	More runoff of rain into the river	Physical
Urbanisation	Impermeable concrete surfaces result in less infiltration and more runoff of rain into the river	Human
Soil type	Non-porous soil allows less rainwater to seep underground and so more runoff reaches the river	Physical

Activity 8 **(LB page 55)**

1. There is no floodplain connection because artificial levees have been constructed on the banks of the river. These stop the river from flowing onto the floodplain. As floodwater does not reach the floodplain, the floodplain is less fertile because no alluvium is deposited.
2. Water in the river flows into the dam and the river deposits sediment in the dam. As a result, less sediment is deposited downstream of the dam, reducing the fertility of the floodplain.

Activity 9 **(LB page 56)**

1. Heavy rain brought by Cyclone Idai caused rivers to overflow their banks. Mozambique is fairly flat and close to sea level. Water in rivers therefore does not drain away quickly.
2. Climate change results in warmer temperatures, which increase the severity of storms like Cyclone Idai. Global warming and climate change are caused by human activities, for example, the burning of fossil fuels, which lead to increasing amounts of carbon dioxide in the atmosphere.

3. Mozambique's flood management techniques rely mostly on forecasts and warnings, as the government has been unable to afford the costs of hard and soft engineering options. Despite recent investments, the severity of the storm meant that existing warning systems were inadequate. There was insufficient planning for evacuation. Poor road infrastructure made it difficult to evacuate or to send response teams to provide aid. Rescue teams and emergency services were unable to cope, and the lack of shelter, clean water, food and sanitation services meant that the country had to rely on aid from international organisations.
4. Learners' answers will vary. Accept any suitable answers, for example:
   The people suffered famine, destroyed infrastructure, homes, crops and livelihoods, diseases such as cholera, and death. Environmental effects include the washing away of topsoil, damage to vegetation and the pollution of water supplies.

Continuous assessment

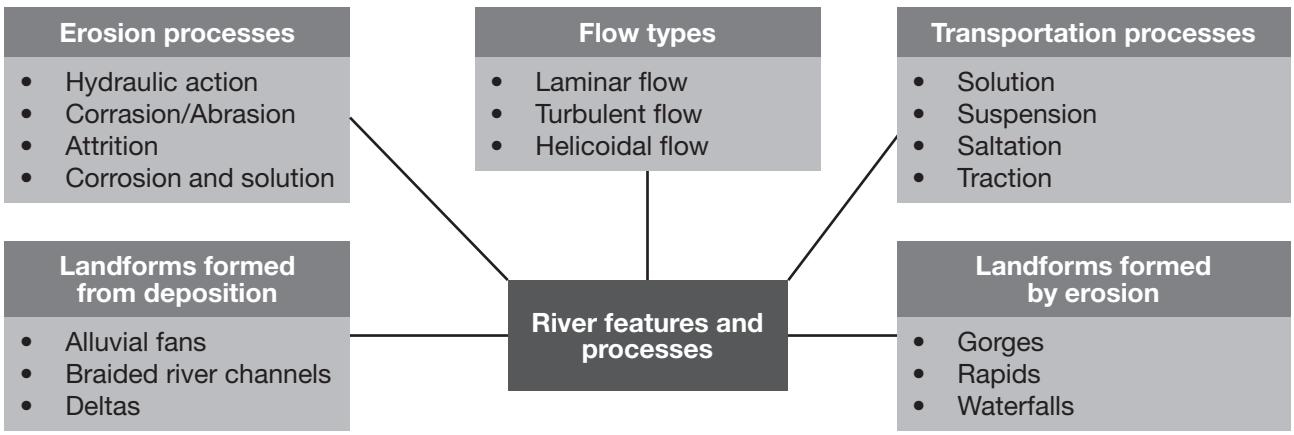
Go through the answers to Activities 7, 8 and 9 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Remedial and extension activities

Remedial

Learners can draw a mind map to summarise the different river features and processes.

Suggested answers



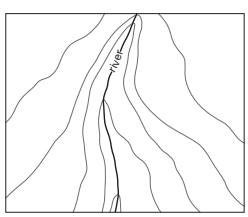
Extension

Learners must draw contour sketches to show the following river features:

1. A river valley in the upper course
2. A river valley in the lower course
3. A waterfall
4. A gorge

Suggested answers

1.



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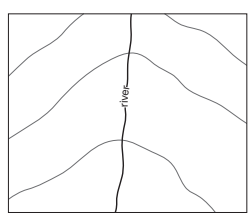

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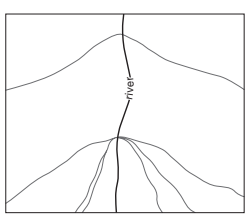
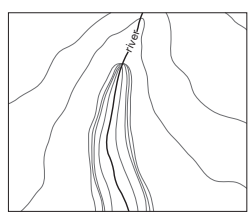


4.



TOPIC 1.4 The drainage basin system

LB pages 57–64

Beginning these lessons

Prior knowledge: Learners should be able to remember what they learnt about drainage basins and the hydrological cycle in previous grades.

This topic focuses on the inputs, outputs, stores and flows of the drainage basin system. Learners look at how these components vary depending on the climate. The concept of water balance is also covered, as well as how people modify the water cycle.

Starter activity

This activity illustrates the different areas where water is found on the Earth. Learners need to be aware of how little of our water is fresh water, and that most water on Earth is salty and found in the ocean. Learners interpret Figure 1.4.1 and see the following:

- A large percentage of our fresh water forms ice caps and glaciers.
- Little fresh water is found on the surface and there is more water underground.
- Fresh surface water is found in rivers, swamps and lakes.

Learners can work in pairs to complete the activity. Ensure that any learners with visual impairments work with a sighted learner who can describe Figure 1.4.1 to them. Afterwards, hold a class discussion, so that learners can compare responses.

Suggested answers

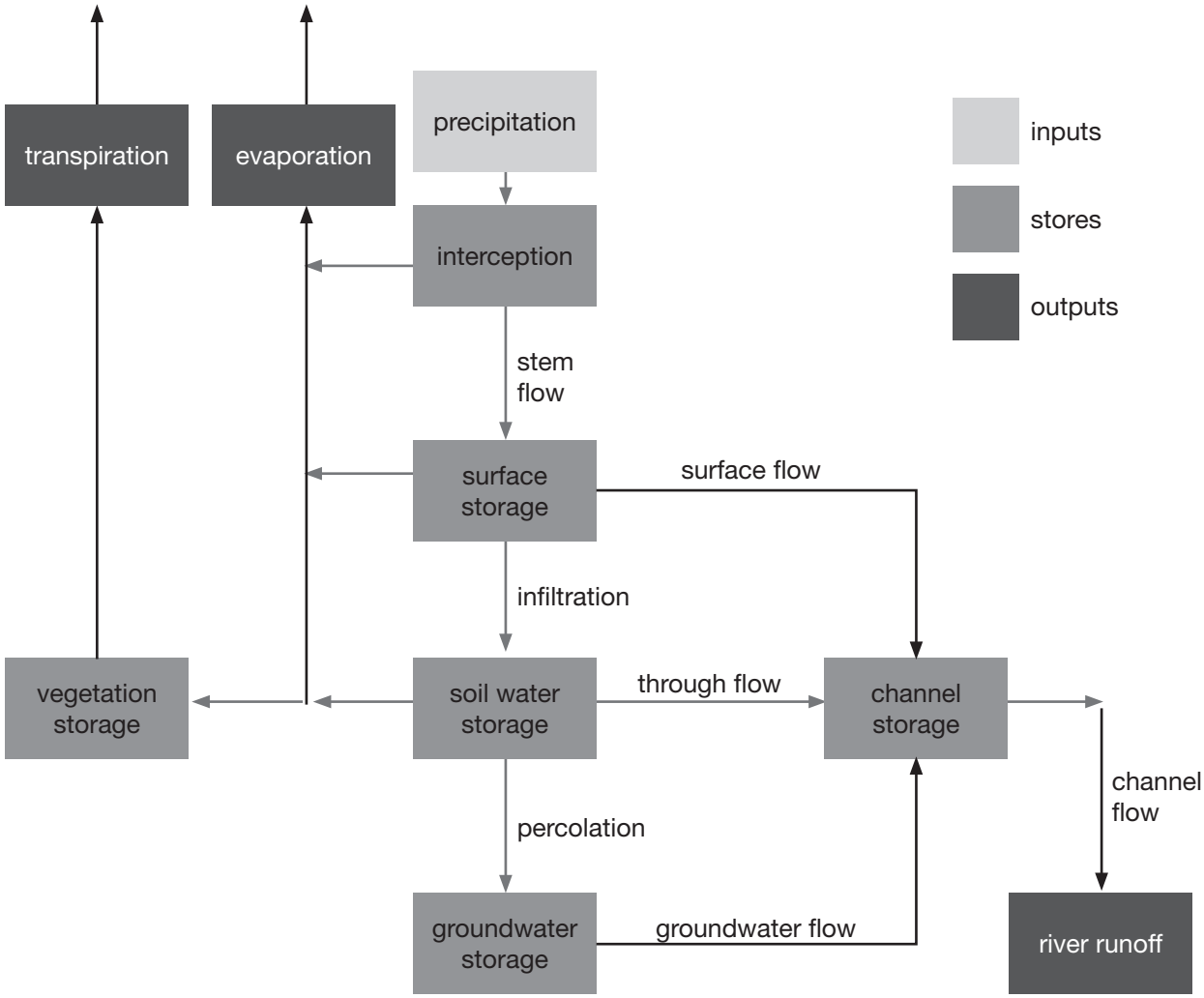
1. 3%
2. **a)** 0.3%
   b) 30.1%
3. Lakes
4. 87%
5. Atmospheric water is clouds and precipitation, biological water is found in plants and animals, and soil moisture is water that has infiltrated into the soil.
6. Ice caps and glaciers make up 68.7% of fresh water on Earth, so groundwater (30.1%) is our largest accessible source of fresh water.
7. Living organisms cannot live without water. Humans, animals and plants need water. Humans also need water for many economic activities, for example, farming and industry. Without water there will be no food. Households also need water for cooking, cleaning and sanitation.

The drainage basin as a system

Teaching tips

- Revise the hydrological system and stress that this system is a cycle with no beginning and no end, and the supply of water is constant. Remind learners that water is found in different forms (as a gas, liquid or solid) and also in different places (in the atmosphere, soil, plants, animals, underground and on the surface).
- Explain that the drainage basin is an open system. Water enters the drainage basin when precipitation takes place (input) and then moves through the drainage basin (flows) or is collected in the drainage basin in lakes, rivers and underground (stores). Water leaves the drainage basin when rivers flow into the ocean (output). Explain the inputs, stores, flows and outputs in more detail using Figure 1.4.2 in the Learner's Book. Define and explain terms that learners are unfamiliar with, for example, those related to underground water.
- Some learners may find it helpful if you sketch a flow diagram similar to the one on the next page on the board. If possible, use different colours for the input, stores and outputs.
- Learners then complete Activity 1 on their own. However, learners with visual impairments will need to work with a sighted learner so that Figure 1.4.2 can be described to them.

Flow diagram of the drainage basin system



Homework

Activity 1 can be finished at home, if necessary.

Continuous assessment

Go through the answers to Activity 1 with the learners in class in the next lesson. Learners can mark their own work. You may record their marks for continuous assessment.

Suggested answers

Activity 1 **(LB page 59)**

Inputs	Stores	Flows	Outputs
Precipitation	Interception	Infiltration	Transpiration
	Vegetation storage	Percolation	Evaporation
	Surface storage	Channel flow	River runoff
	Soil moisture	Surface runoff	
	Groundwater	Through flow	
	Channel storage	Groundwater flow	

Variation of the components of the hydrological system by climatic region

Teaching tips

- Revise the climatic regions covered in Grades 10 and 11. Focus on the tropical rainforest, tropical grassland and tropical desert regions. Make sure learners recall the main temperature, rainfall and vegetation characteristics of each of the climatic regions.
- Using question-and-answer methodology, ask learners how they think changes in temperature, precipitation and vegetation cover influence the components of the hydrological system. They should realise that as temperature, rainfall and vegetation cover vary by climatic region, input, output, stores and flows differ in each of the zones. Table 1.4.3 in the Learner's Book gives a concise summary of this.

Origin of groundwater

Teaching tips

- Spend some time on this topic, as there are a number of concepts and terms that are new to the learners. Learners must understand what the water table is and why it varies by season and by region, depending on climate, relief, vegetation, and soil and rock types. Explain the nature of permanent rivers, periodic rivers and ephemeral (episodic) rivers, and how the position of the water table determines whether a river is fed with underground water.
- Learners then work through Activity 2 in pairs. Ensure that any learners with visual impairments work with a sighted learner who can describe Figure 1.4.6 to them.

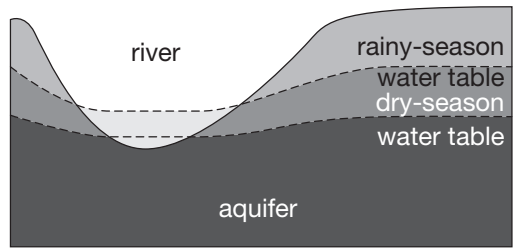
Homework

Activity 2 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

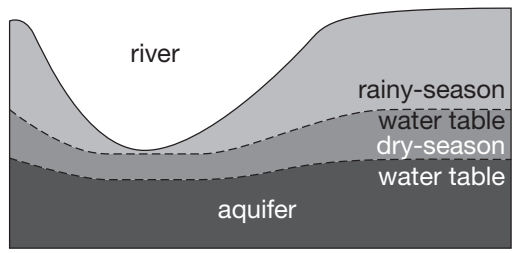
Suggested answers

Activity 2 **(LB page 61)**

1. a)



b)



2. a) Pervious rock has cracks that water can move through, while porous rock has pore spaces through which water can move.

b) Aquifers are rocks that can hold water, while aquicludes are rocks that cannot hold water.

3. a) Precipitation

b) Groundwater originates from precipitation that has infiltrated into the soil.

c) Surface flow, groundwater flow and channel flow

d) The water table intersects the surface of the Earth on the side of a hill and groundwater seeps onto the Earth's surface.

e) The base of the well extends below the water table into the rock underground that is saturated with water.

f) It is impermeable and does not allow water to move through it.

g) It is an output, as water evaporates into the atmosphere and leaves the drainage basin.

Continuous assessment

Go through the answers to Activity 2 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Water balance and modification of the hydrological cycle by people

Teaching tips

- Explain what the water balance is and then ask learners why knowing the water balance is important. Give the learners the formula for calculating the water balance. Ensure they know what each of the symbols represents. Explain and define water surplus, field capacity, water deficiency and recharge. Check if learners can tell you when there will be a water surplus and when there will be a water deficiency.
- Learners complete Activity 3 on their own.
- Discuss how people modify the cycle. Table 1.4.4 in the Learner's Book will assist you.
- Learners then work through Activity 4 in pairs.

Homework

Activity 3 can be finished at home, if necessary. Ideally, learners should complete Activity 4 in class, as they are working in pairs.

Suggested answers

Activity 3 **(LB page 63)**

1. November, December, January, February, March, April
2. Positive
3. May to September
4. In October, precipitation has begun to exceed evapotranspiration, so soil water stores begin to recharge.
5. November
6. A water surplus can result in wet soils and high river levels, but a water deficit leads to dry soils and low river levels.

Activity 4 **(LB page 64)**

1. Precipitation (rain, snow)
2. Learners' answers will vary. Accept any suitable answers, for example:
   Runoff: Water flows overland from rain and snow.
   Through flow: Water infiltrates into the soil and flows in the soil.
3. Learners' answers will vary. Accept any suitable answers, for example:
   Groundwater storage: Water that infiltrates the soil also percolates into the permeable rocks where it is stored as groundwater.
4. Evaporation and evapotranspiration
5. Learners' answers will vary. Accept any suitable answers, for example:
   Water is stored in the reservoir and released into the river when necessary; treated waste water is released into the river; stormwater drains release water into the river; abstraction of water that is treated for drinking.

Continuous assessment

Go through the answers to Activities 3 and 4 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Remedial and extension activities

Remedial

Learners must explain one way in which the following human activities affect the water balance in an area:

1. Water abstraction
2. Urbanisation

Suggested answers

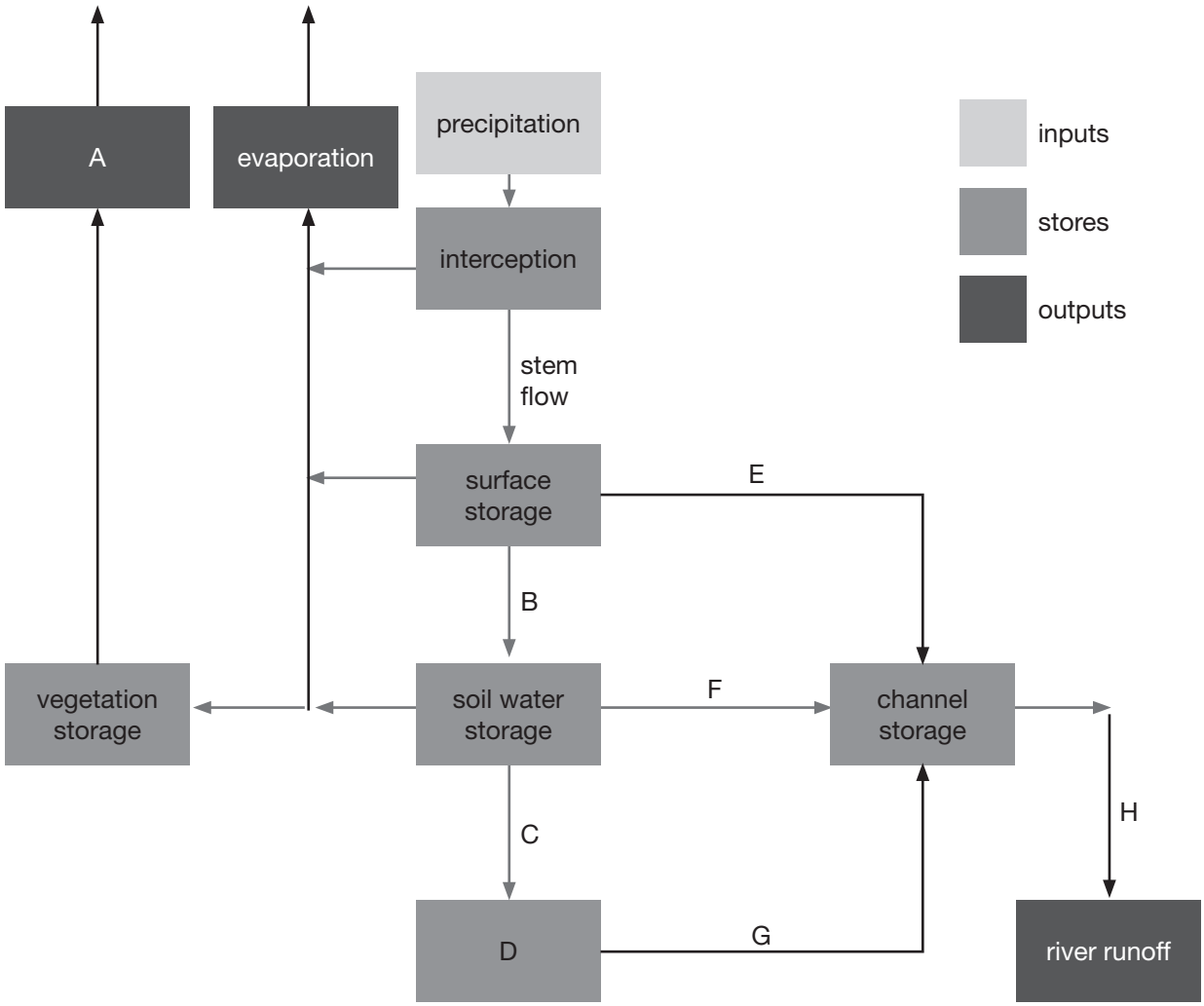
Learners' answers may vary. For example:

1. People use water to irrigate their crops. This reduces the amount of water stored in the area.
2. People build tar roads. These surfaces are impermeable, and so there is less infiltration. As a result, groundwater stores are reduced.

Extension

Learners can copy and complete the diagram of the drainage basin system below by supplying labels for features A to H.

Flow diagram of the drainage basin system



Suggested answers

A. Transpiration
B. Infiltration
C. Percolation
D. Groundwater storage
E. Surface flow
F. Through flow
G. Groundwater flow
H. Channel flow

TOPIC 1.5 Rainfall-discharge relationships within drainage basins

LB pages 65–71

Beginning these lessons

Prior knowledge: Learners have not learnt about hydrographs before.

In this topic, learners study hydrographs and learn about the factors that influence the shape of the hydrograph, such as climate, soils, rocks, slopes, vegetation and land use. Learner's with visual impairments will require extra help reading information from the hydrographs throughout this topic.

Starter activity

This activity revises some of the content covered thus far and encourages learners to apply what they have learnt to hydrographs.

Learners can work in pairs to complete the activity. Ensure that any learners with visual impairments work with a sighted learner who can describe the graphs in Figure 1.5.1 to them. Afterwards, hold a class discussion, so that learners can compare responses.

Suggested answers

1. Discharge is the amount of water flowing past a point in the river in a specific time.
2. Summer, as the rivers are in the southern hemisphere and the hottest months are November, December, January and February, which are the months when there is most discharge in the river.
3. August
4. High discharge indicates that rainfall is high. The discharge of Rivers A and C is high in some seasons, so rainfall is seasonal and does not fall all year. River B shows little discharge throughout the year, indicating low rainfall. A little rain falls in January, March, June and November as there is some discharge at these times.
5. a) None of the graphs show rainfall all year.
   b) River C, as discharge is high in summer
   c) River B, as discharge is low all year, showing that there is little rain

Components of hydrographs

Teaching tips

- Spend some time explaining hydrographs and the components of hydrographs as this is a new area for learners. Differentiate between a hydrograph that shows the annual discharge of a river and a flood hydrograph. Learners need to know the terms *lag time*, *flood peak*, *rising limb*, and *falling (receding) limb*. Explain that base flow is the groundwater that seeps into a river. You could use this opportunity to review the concept of the water table, why it rises and falls, and how the position of the water table influences rivers and determines whether a river flows with base flow or not. Also revise the different types of rivers. When you define discharge, quickly recap on the drainage basin system and its relevant terms, making sure that learners understand fully.
- If possible, have learners draw their own hydrograph using statistics you provide to help them understand hydrographs. Example statistics are given in the tables below, together with some suggested questions you could ask the learners to answer:
  - » On the *y*-axis: Show discharge in 10 cumec intervals (left-hand side); show rainfall in 5 mm intervals (right-hand side).
  - » On the *x*-axis: Show time in hrs.

Time (Hrs)	0	2	4	6	8	10	12	14	16	18	20
Discharge (cumecs)	30	36	45	80	130	100	70	50	40	35	30

Hours (hrs)	1st	2nd	3rd	4th	5th	6th
Rainfall (mm)	10	30	40	25	15	5

Questions:

a) What information does the horizontal axis of the graph show?
b) In which unit is rainfall expressed?
c) In which unit is discharge expressed?
d) When did the most rainfall occur?
e) When does the discharge peak?
f) How long is the lag time?

- Learners then complete Activity 1 in pairs. Ensure that any learners with visual impairments work with a sighted learner who can describe Figure 1.5.2 to them.
- Describe and explain the flow hydrograph in the Learner's Book (Figure 1.5.3), and discuss how it differs from the flood hydrograph (Figure 1.5.2).

Homework

Activity 1 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 1 **(LB page 67)**

1. ±160 mm
2. ±4 cumecs
3. ±50 mm
4. ±34 cumecs
5. Lag time is the time between the rainfall peak and the discharge peak.
6. It takes time for the rain to infiltrate, for the soil to become saturated and for the runoff to reach the river.
7. Base flow increases after peak discharge.
8. The rising limb is steeper than the falling limb.
9. Although surface runoff into the river has decreased, discharge falls more slowly than it increases, as more base flow is seeping into the river.

Continuous assessment

Go through the answers to Activity 1 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Factors that influence the shape of a hydrograph: Climate, soil texture, rocks, slopes, vegetation and land use

Teaching tips

- Discuss the factors that influence the shape of the hydrograph. The Figure 1.5.4 mind map will assist you with this and allow learners to note the factors you will be discussing.
- Begin by discussing rainfall and temperature, evaporation and evapotranspiration. Use question-and-answer methodology, as learners should be able to determine much of these on their own. Then, explain the influence of antecedent moisture.
- Discuss the influence of soil texture, rocks, slopes, vegetation and land use on hydrographs. Again, learners should be able to work out how these influence the shape of the hydrograph. Study and interpret the many hydrographs that have been used in the Learner's Book as examples. At all times, ask learners to recall what they have learnt about the drainage basin system and identify the areas where they lack understanding.
- Learners then work through Activity 2 in pairs. Ensure that any learners with visual impairments work with a sighted learner who can describe Figure 1.5.8 to them.
- Discuss how the shape and size of a drainage basin influence the shape of the hydrograph.
- Learners could copy the Figure 1.5.4 mind map and add key words to each factor to help them remember what has been discussed.
- Learners can then complete Activity 3 on their own.

Homework

Activity 3 can be finished at home, if necessary. Ideally, learners should complete Activity 2 in class, as they are working in pairs.

Suggested answers

Activity 2 **(LB page 71)**

1. The rising limb is steep, because many surfaces are artificial and impermeable, so there is a lot of runoff that reaches the river in a short space of time.

2. The impermeable surfaces prevent water from infiltrating underground.
3. The falling limb has a gentle gradient, as there has been infiltration of rainwater, the water table has risen, and more base flow is reaching the river and flowing in the river.
4. Flooding is more likely to be a hazard in the urbanised area, as more rainwater runoff reaches the river. The runoff also reaches the river in a shorter space of time.

Activity 3 **(LB page 71)**

Factor	Total rainfall	Intensity of rainfall	Antecedent moisture	Rock/soil type	Ground cover	Slope angle	Nature of the drainage basin
Steep rising limb, short lag time	A high amount of rain	Heavy rain in a short period of time	Saturated soil	Impermeable rocks/ surfaces/ clay	Little vegetation	Steep	Large and circular, many streams

Continuous assessment

Go through the answers to Activities 2 and 3. Learners can mark their own work. You could record their marks for continuous assessment.

Remedial and extension activities

Remedial

Learners must write down clear definitions for the following terms:

1. Annual runoff regime
2. Flood hydrograph
3. Flood peak
4. Lag time
5. Base flow

Suggested answers

1. The discharge of a river over the course of a year
2. A graph to show the discharge of a river during and after a rain storm
3. The greatest discharge in a river
4. The time between peak rainfall and peak discharge
5. The groundwater that has seeped into a river and that is flowing in the river

Extension

Learners can draw flood hydrographs indicating the lag time and flood peak of a river under the following circumstances:

1. The drainage basin is circular.
2. The area is deforested.
3. The area is afforested.
4. The area is urbanised.
5. There is a second rain storm shortly after a period of heavy rain.

Suggested answers

Flood hydrographs for 2, 4 and 5 should show a short lag time and a high flood peak. Flood hydrographs for 1 and 3 should show a long lag time and a low flood peak.

TOPIC 1.6 Atmospheric processes

LB pages 72–89

Beginning these lessons

Prior knowledge: Learners have not covered the vertical structure of the atmosphere before. Although they have learnt about different temperatures across the world, they have not learnt about the heating of the atmosphere or heat energy budgets. Global warming and climate change have been covered in previous grades, but learners have not considered how people affect city climates.

In this topic, learners study the vertical structure of the atmosphere and how the atmosphere is heated. They also learn about energy budgets. The global and local effects of climate change are evaluated and the impact of people on the microclimate of urban areas is taught.

Starter activity

This activity aims to make learners aware how thin our atmosphere is and how important it is for life of Earth.

Learners can work in pairs to complete the activity. Ensure that any learners with visual impairments work with a sighted learner who can describe Figure 1.6.1 to them. Afterwards, hold a class discussion, so that learners can compare responses.

Suggested answers

1. The Earth is bigger than the Moon. It only appears smaller in the photograph because it is in the background and the Moon is in the foreground.
2. The atmosphere is very thin in comparison to the size of the Earth.
3. Gases such as nitrogen, oxygen, water vapour, carbon dioxide and so on
4. The Moon does not have an atmosphere.
5. **a)** Our atmosphere provides us with the gases we need for life. We experience precipitation because the atmosphere contains water vapour. The gases have weight, so we have atmospheric pressure.
   b) The Moon has no gas, so it is dry and there is no atmospheric pressure.

The troposphere, stratosphere, mesosphere and thermosphere

Teaching tips

- This is an interesting and relatively easy section to teach. Spend some time discussing space exploration, space travel and satellites to create interest. Discuss the importance of the atmosphere, getting feedback from the learners. You can expand on their answers to Question 5 of the Starter activity. Learners might not have mentioned that the atmosphere also protects us from harmful rays of the Sun and that it acts like a blanket, keeping the Earth warm.
- List the different atmospheric layers, beginning with the layer closest to the Earth's surface (the troposphere). Explain the characteristics and temperature of each of the layers. Table 1.6.1 and Figure 1.6.2 in the Learner's Book will assist you. To help the learners remember which layer is which, tell them that:
  - » *tropo* means *mixing*
  - » *strato* means *layered*
  - » *meso* means *middle*
  - » *thermo* means *heat*.
- Learners with visual impairments will need help interpreting Figure 1.6.2.
- Learners then work through Activity 1 in pairs. Ensure that any learners with visual impairments work with a sighted learner who can describe Figure 1.6.3 to them.

Homework

Activity 1 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 1 **(LB page 74)**

1. **a)** ±15 °C, ±1040 mb
   b) ±-55 °C, ±250 mb
   c) ±-55 °C, ±100 mb
   d) ±-5 °C, ±0 mb
   e) ±-95 °C, ±0 mb
2. Pressure decreases with altitude as the amount of gases in the atmosphere gets less and less the further away you go from the Earth's surface.

3. **a)** ±5 000 m
   b) ±6 000 m
   c) ±10 000 m
4. ±24 000 m–27 000 m
5. The ozone layer prevents harmful ultraviolet radiation from reaching the Earth.
6. **a)** Exosphere **b)** Mesosphere
   c) Thermosphere **d)** Stratosphere
7. There are very few clouds.

Continuous assessment

Go through the answers to Activity 1 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Heating of the atmosphere by insolation; Effect of cloud cover

Teaching tips

- Explain to learners how insolation heats the Earth's surface and the hot surface then gives off heat to heat the atmosphere. Clearly differentiate between insolation and terrestrial radiation. Describe how some insolation is reflected, absorbed and scattered before reaching the Earth's surface.
- Discuss how clouds impact insolation and terrestrial radiation. Draw sketches on the board and use the figures in the Learner's Book as you go through this section.
- Learners complete Activity 2 on their own.

Homework

Activity 2 can be finished at home, if necessary.

Suggested answers

Activity 2 **(LB page 77)**

1. **a)** Insolation is short-wave radiation that enters the Earth's atmosphere and heats the surface of the Earth.
   b) Terrestrial radiation is long-wave radiation that is given off by the heated surface of the Earth, heating up the atmosphere.
2. Albedo is the ratio between incoming radiation and reflected radiation.
3. B will have the highest albedo, as it is white, which reflects more radiation. C will have the lowest albedo, as it is dark in colour. (A has a high albedo, as it is a light colour.)
4. Scattering happens when electromagnetic waves are intercepted by particles and redirected. Reflection is when waves bounce off objects and no energy is transferred to the object.
5. Clouds perform the same function as a blanket. A blanket traps the heat given off by a person, while clouds trap the heat given off by the Earth's surface.

Continuous assessment

Go through the answers to Activity 2 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

The Earth's (global) energy budget; Latent heat and sensible heat transfers

Teaching tips

- Explain the energy budget using the diagram and table in the Learner's Book. Learners must understand that the Earth's energy budget refers to the total amount of energy entering the atmosphere, the amount of energy leaving the atmosphere and the transfer of energy within the atmosphere. Spend some time making sure that learners understand how to interpret the energy budget and remember the percentages involved. Learners also need to understand that the percentages given can vary with time and place.
- Explain the processes of conduction, convection and the transfer of heat by the release of latent energy. If possible, collaborate with a Science teacher to provide a demonstration of these processes, if learners are having difficulty with the section.
- Divide the class into groups for Activity 3. Ensure that sighted learners help explain the diagrams to learners with visual impairments, and that learners with hearing impairments are accommodated.
- Explain conduction, convection and latent heat transfer in more detail. Learners need to understand that latent heat is the heat that is absorbed or released when a substance changes from one state to another. Go through the Figure 1.6.13 graph. Point out that when condensation takes place and water vapour changes into liquid water, latent heat is released, contributing to the warming of the atmosphere. Using the graph, question learners as to what happens during other phase changes.
- Learners complete Activity 4 on their own.

- Briefly discuss how the energy budget varies depending on latitudinal position. Much of this section is applying learners' new knowledge to what they have learnt in previous years.

Homework

Activity 4 can be finished at home, if necessary. Ideally, learners should complete Activity 3 in class, as they are working in groups.

Suggested answers

Activity 3 **(LB page 78)**

1. 100%
2. 30%
3. 70%
4. 100%
5. 51%
6. It is absorbed by water vapour and other gases, clouds, ozone and dust.
7. **a)** 7%
   b) 23%
   c) 21%
8. Yes, as the Earth receives 51% insolation, and conduction, convection, terrestrial radiation and latent heat transfers total 51%.
9. 45%
10. 6%
11. Clouds reflect insolation, and trap and absorb terrestrial radiation, so these percentages vary with the amount of cloud cover there is at a particular place and at a given time.

Activity 4 **(LB page 79)**

1. Sensible heat is the actual heat that you feel; the actual heat of an object or gas. Latent heat is the heat that is absorbed or released when a substance changes from one state to another.
2. **a)** Evaporation (when liquid water changes into water vapour), melting (when ice melts) and sublimation (when ice sublimates into water vapour)
   b) Freezing (when liquid water changes into ice), condensation (when water vapour changes into water) and crystallisation (when water vapour changes into ice)

Continuous assessment

Go through the answers to Activities 3 and 4 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

The daytime and nighttime energy model

Teaching tips

- Point out that the Earth's energy budget applies to the globe as a whole. Tell learners that they will now look at how the energy budget varies from day to night in a specific area.
- Help learners interpret the information in Figure 1.6.16, which shows maximum and minimum temperatures in relation to energy gain and loss in a 24-hour period. Learners with visual impairments will need you to describe this model clearly so they can understand what it shows.
- Discuss the energy components of the daytime energy model and the nighttime energy model. The tables and diagrams in the Learner's Book will assist you with this. Ask learners to define and explain each component as they should know these terms from the previous section. Then help them apply the concepts to the daytime/nighttime energy budget.
- Learners work through Activity 5 in pairs. Learners with visual impairments should work with a sighted learner who can help them with the Question 6 drawing.

Homework

Activity 5 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 5 **(LB page 82)**

1. Learners' answers will vary. Any two of the following: Insolation, latent energy transfer, sensible heat transfer
2. Terrestrial (long-wave) radiation
3. Terrestrial (long-wave) radiation, radiational cooling
4. Condensation close to the Earth's surface forms dew and latent heat is released.
5. Terrestrial radiation continues at night, cooling of the Earth's surface. This is called radiational cooling. On clear, cloudless nights, there is a lot of radiational cooling, as there is no cloud blanket to trap terrestrial radiation. As the surface cools, dew or frost may form on the surface.

6. Learners' drawings must match Figure 1.6.16 in the Learner's Book.
7. There is less input from insolation during the day, as the clouds cause maximum reflection of insolation. However, output of energy is also reduced, as the clouds prevent terrestrial radiation from escaping into space.

Continuous assessment

Go through the answers to Activity 5 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Climate change and its effects in the global and local context

Teaching tips

- Global warming and climate change have been covered in detail in previous grades. They are also often mentioned in the media and in general conversation. Discuss these processes with your learners to find out how much they know, and then explain and describe the processes and effects in more detail. Make sure learners know the difference between climate change and global warming.
- Point out how human activities have contributed to climate change. Learners should be able to differentiate between the natural greenhouse effect and the enhanced greenhouse effect.
- Expand on the global impact of climate change, and the potential effects in Africa and Namibia. Use this opportunity to bring in the cross-curricular issue of ICT and its use in monitoring and predicting climate change.
- Learners the complete Activity 6 in pairs.

Homework

Activity 6 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 6 (LB page 86)

1. Global warming is the rise in the average temperature of the Earth's atmospheric. Climate change happens as a result of global warming, for example, hotter temperatures lead to changes in climates. Climate change is a long-term change in weather patterns.
2. The greenhouse effect is when heat is absorbed by greenhouse gases, warming the atmosphere. The enhanced greenhouse effect is when there are greater concentrations of greenhouse gases, such as carbon dioxide and methane, in the atmosphere. This leads to the atmosphere being warmer than it should be.
3. Global warming leads to changes in atmospheric pressure and wind patterns. This affects the amount of precipitation and evaporation in different areas. Some areas experience more severe storms, while other areas could experience drought.
4. Greenhouse gas emissions refer to human activities that release greenhouse gases, such as carbon dioxide, methane and carbon monoxide, into the atmosphere.
5.

Global impact of climate change	Local impact of climate change
Learners' answers will vary. Accept any four of the following or other suitable answers: • Sea levels rise, flooding coastal areas • Increased moisture loss from the soil and declining crop yields • Risk to ecosystems such as forests, wetlands and coral reefs • Disappearing glaciers • Increased deaths and illness due to extreme weather events, air pollution and infectious diseases carried by mosquitoes • Decrease in the availability of clean drinking water • Damage to land and sea organisms, threatening food production	Learners' answers will vary. Accept any four of the following or other suitable answers: • Decreased food security and increased malnourishment and undernourishment • Agriculture and fishing threatened by drought conditions • Increase in poverty, unemployment and rural–urban migration • Damaged infrastructure due to floods • Damaged ecosystem and animal habitats • Increase in human diseases, such as cholera and bilharzia, as well as animal and plant diseases • Increased zone in which mosquitoes are found

Continuous assessment

Go through the answers to Activity 6 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Impact and effects of human activities in an urban area on climate

Teaching tips

- The urban heat island is a new concept for your learners, but they should be able to evaluate the impact of human activities on temperatures in a city from what they have already learnt. Have a class discussion to see how many of the factors that influence city temperatures learners can work out for themselves.
- Then, discuss each factor in detail. List them on the board in two columns by dividing them into factors that are caused by conditions in the atmosphere and factors that are caused by conditions of the urban surfaces.
- Explain why we refer to a city as being a heat "island" (the city is warmer than the surrounding rural area). Discuss how humidity, precipitation and winds differ in the city compared to the rural area.
- Go through the two case studies with the learners. Learners with visual impairments will need help understanding what is shown in Figure 1.6.25.
- Learners take on Activity 7 on their own.

Homework

Activity 7 can be finished at home, if necessary.

Suggested answers

Activity 7 **(LB page 89)**

1. a) Temperatures are higher in a city than in the surrounding rural area. This is especially noticeable in the centre of the city (CBD).
b) Humidity is lower in cities.
c) Cloud cover is greater in cities.
d) There is heavier rain in cities.
e) Wind speed may be low due to friction with the tall city buildings, but can also be strong if channelled between buildings.

2. Learners' answers will vary. Any one of the following: More concrete/tar, many buildings

3. There is more air pollution, including increased carbon dioxide, which absorbs heat, dust and smoke.

4. Yes, as human activities create more greenhouse gases in a cities.

5. a) More green, vegetated areas mean there are fewer artificial surfaces and thus less absorption of heat, as well as more evapotranspiration and less carbon dioxide.
b) Light colours have a higher albedo, so there will be more reflection of insolation.

Continuous assessment

Go through the answers to Activity 7 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

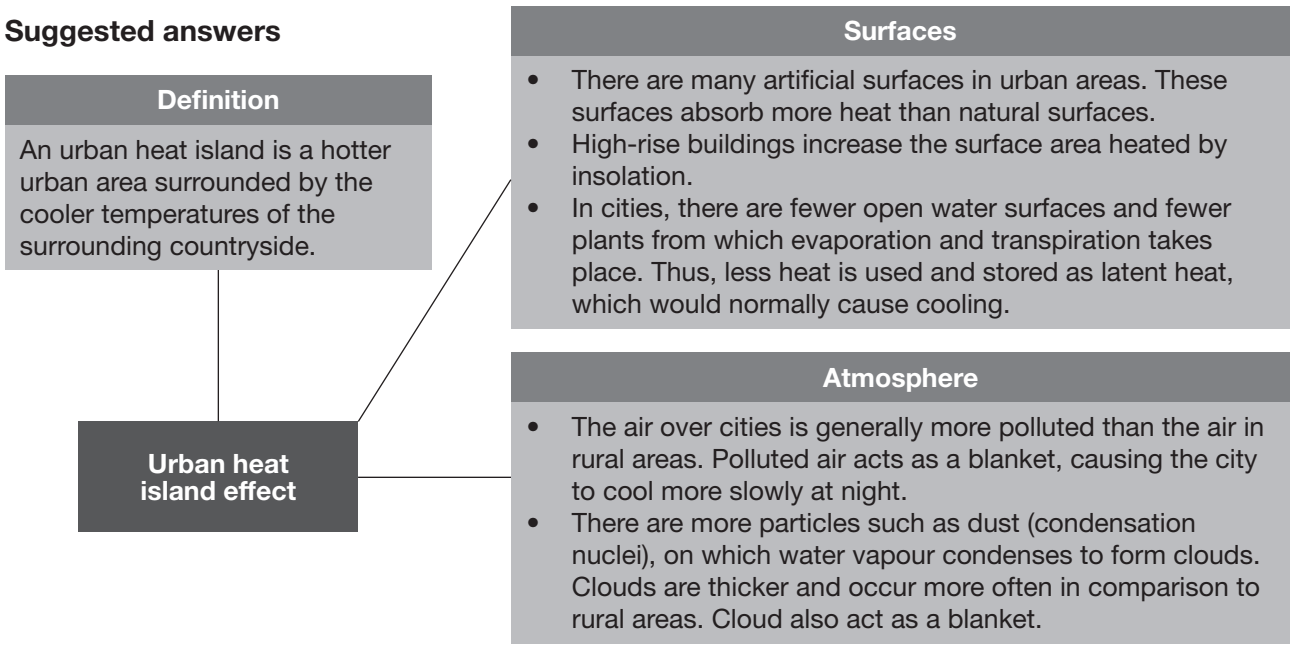
Remedial and extension activities

Remedial

Learners can draw a mind map to revise urban heat islands. The mind map must include "Urban heat island effect" in the centre and branches with each of the following:

- Definition: Define the term urban heat island.
- Surfaces: Under this branch, more information must be given about how the surfaces in a city are different and why this results in more heat.
- Atmosphere: Under this branch, more information must be given about how the atmosphere over city is different and why this results in more heat.

Suggested answers



Extension

Learners must give three reasons why rooftop gardens (green roofs) are an effective way to reduce the urban heat island effect.

Suggested answers

Plants growing on a roof provide shade and prevent the top of the building from receiving the full, direct sunlight that would ordinarily heat it up. This means that the building surface does not give off as much heat into the atmosphere of the city. The plants also cool the inside of the building, so air conditioners are not needed. This reduces artificial heat generation in the city. Additionally, the plants take in carbon dioxide and so there is less absorption of terrestrial radiation. Evapotranspiration takes place off the plants and this removes some heat from the atmosphere.

Self-assessment (LB pages 92–93)

Topic 1.1 Plate tectonics

1. a) Place on the surface immediately above the point in the Earth's crust where an earthquake begins (1)

b) Intrusion of dolerite rock that cuts across layers of rock at an angle (1)

c) Horizontal sheet of dolerite rock that has cooled between the bedding planes of rock strata (1)

d) Magma flows into spaces in the crust but does not come out onto the Earth's surface (1)

e) Point in the Earth's crust where an earthquake begins (1)

2. Divergent plate margins are where two plates are moving away from one another, convergent plate margins are where two plates are moving towards one another, conservative plate margins are where two plates are moving horizontally alongside one another. (3)

3. a) The East African Rift Valley is a geologically unstable area where the upwelling of magma happens due to tension forces caused by plate movements. (2)

b) Advantages include fertile soils, as volcanic rocks break down to form fertile soils rich in iron and magnesium, which are ideal for crop production; high biodiversity as orographic (relief) rain in volcanic landscapes and fertile soils support the growth of natural vegetation and a wide variety of animal species; mineral deposits, for example, diamonds and copper; and geothermal energy, as steam from active volcanism and heated rocks can be used to supply hot water. Disadvantages include violent volcanic eruptions, which may lead to

death and injury; fires that cause a lot of damage; poisonous gases that cause lung and breathing problems; ash that buries buildings and fields; heavy rain and mudflows caused by steam from the vent; and dust remaining in the atmosphere for a long time. (6) **[16]**

Topic 1.2 Processes on slopes

4. Slope failure is when the force of gravity acting on the loose rock particles is greater than the force of resistance and the loose material begins to move downhill. (2)

5. Soil creep causes small terracettes to develop on the slope; solifluction causes flow marks or lobes of soil and weathered material on slopes; slumps create a short scarp and a curved scar on the slope; a large mass of land breaks loose and falls down the slope during a landslide. (4)

6. a) Mudslide (2)

b) Heavy rainfall lubricated loose particles, lowering their resistance and allowing gravity to move the particles more easily; steep slopes in the area caused weathered material to move rapidly downward. (4)

c) People died, houses were buried and crops and roads were destroyed. (3)

d) A landslide is when a large mass of land breaks away rapidly from the slope and falls as one unit down the slope. A mudslide occurs after rain saturates a slope with high clay content. The water running down the slope collects loose, weathered material. (2)

e) Learners' answers will vary. Accept any two suitable answers, for example: Erecting houses on steep slopes should be prevented, as they add too much weight; vegetation should be maintained on the slopes, so that the roots hold loose material and prevent it from moving. (4) **[21]**

Topic 1.3 River channel processes and landforms on slopes

7. a) Amount of water flowing in a river channel past a point in a given time (2)

b) Small rocks and stones bump against one another, becoming rounder and smoother (2)

8 A river will be able to carry a large load, if it has a lot of energy. A river's energy is higher, if there is a steep gradient, a large volume of water and little friction. (4)

9. When a river flows onto the floodplain, there is a lot of friction, causing the river to lose energy. It is no longer be able to carry all the sediment that it has been transporting. (2)

10. a) Learners' answers will vary. Accept any suitable answer, for example: Artificial levees are built on the riverbanks to prevent a river flooding onto the floodplain. (2)

b) Learners' answers will vary. Accept any suitable answer, for example: Artificial levees prevent rivers from flowing onto the floodplain, so alluvium is no longer deposited and the floodplain becomes less fertile. Therefore, this is not an environmentally sustainable solution to prevent flooding. (2)

11. a) Turbulent (1)

b) The riverbed is uneven and so the water continually changes levels. (1)

c) Rapids (1)

d) Learners' diagrams should match Figure 1.3.24 in the Learner's Book. (3)

e) Large rocks and stones make up the river load. The large rocks will be pushed along the riverbed in a process called traction. Smaller rocks will be bounced along the riverbed in a process called saltation. (3)

f) It is in the upper course, as the valley is narrow and has steep sides. Larger rocks are usually found in the upper course. The river volume is not large, which also suggests this river is in the upper course. (3) **[26]**

Topic 1.4 The drainage basin system

12. a) Water moves through saturated ground below the water table (1)

b) A river that flows all year, as the riverbed always lies below the water table (1)

c) A rock that is permeable and allows water to enter and move through it (1)

d) The process when water given off by plants evaporates to form water vapour (1)

e) The upper surface of saturated rock underground (1)

13. As rainfall is high throughout the year, the drainage basin system has high input all year. Heavy rainfall increases stores and flows, as there is much infiltration, soil moisture store, through flow, percolation, groundwater store and groundwater flow, surface runoff and channel flow. Cloud cover much of the time reduces the output from evaporation and evapotranspiration. (10)

14. C is correct, as the area normally has a positive water balance in winter. Precipitation is greater than the rate of evaporation and evapotranspiration, which decreases in winter due to cooler winter temperatures. (3) **[18]**

Topic 1.5 Rainfall-discharge relationships within drainage basins

15. a) Cubic metres per second (1)

b) Time between rainfall peak and discharge peak (1)

c) Water that flows into the river from beneath the water table (1)

d) Highest discharge in the river after rain (1)

16. a) Soil that is saturated (1)

b) Brief, intense thunderstorm (1)

c) Clay soil (1)

d) Steep gradient (1)

17. a) River A (1)

b) River A (1)

c) River A, as the flood peak is higher and the lag time is shorter. This is because many of the surfaces are impermeable concrete or tar. Water does not infiltrate and flows quickly into the river. (6)

d) Learners' answers will vary. Accept any four suitable answers, for example: Ensure vegetation is maintained, especially alongside the river; have many parks and natural areas where rainwater can infiltrate; encourage people to build houses away from the river; and improve and maintain urban drainage systems. (4) **[20]**

Topic 1.6 Atmospheric processes

18. a) The ratio between incoming radiation and reflected radiation (1)

b) The transfer of heat when a substance changes from one state to another (1)

c) Cooling of the surface from which terrestrial radiation takes place (1)

d) Higher average temperatures in cities mean that they are islands of heat surrounded by cooler rural areas (1)

19. Conduction and convection (2)

20. Insolation is the incoming short-wave radiation from the Sun during the day and terrestrial radiation is the long-wave radiation given off by the heated surface of the Earth. (4)

21. Some insolation is reflected off clouds and light-coloured surfaces, and is not absorbed by the Earth. Some of it is scattered by particles (such as dust particles) and does not reach the Earth. Some insolation is absorbed by water vapour and gases, such as carbon dioxide before it reaches the Earth. (5)

22. Troposphere and mesosphere (2)

23. Greenhouse gases in the atmosphere absorb terrestrial radiation, keeping the atmosphere warm enough for life on Earth to survive. This is the natural greenhouse effect. Increased amounts of greenhouse gases, such as carbon dioxide, carbon monoxide and methane, mean that more terrestrial radiation is absorbed by the atmosphere, warming it up too much. This is the enhanced greenhouse effect. It is caused by human activities that emit greenhouse gases, for example, industry and combustion. (4)

24. The Earth or global energy budget refers to the amount of energy entering the atmosphere, the amount of energy leaving the atmosphere and the transfer of energy within the atmosphere. (3) **[24]**

Total: 125 marks

Theme 2 Economic activities and the use of resources

Syllabus coverage	See the year plan in Section B (pp. 11–16)
General objectives	**Topic 2.1: Manufacturing industries** Understand the dynamic nature of manufacturing industries **Topic 2.2: Agriculture** Understand different agricultural systems and their social, economic and environmental implications **Topic 2.3: Energy and mining** Understand various sources of energy and minerals and their impact on the environment **Topic 2.4: Water** Understand the demand and supply of water, and the socio-economic and environmental impacts of water surpluses and deficits
Specific objectives	The specific objectives are listed in the year plan in Section B in this Teacher's Guide and at the beginning of each topic in the Learner's Book.
Cross-curricular issues	• Environmental Learning: Topics 2.1–2.4 • Population Education: Topics 2.1–2.4 • Gender Issues: Topics 2.1 and 2.2 • Information and Communication Technology (ICT): Topics 2.1 and 2.2 • Education for Human Rights and Democracy: Topic 2.4 • HIV and AIDS: Topic 2.4
Inclusive education	• Learners with visual impairments need assistance with understanding diagrams, maps and photographs. • Learners with hearing impairments need to be accommodated during group work activities and class debates. Have other learners assist them with visual clues or notes, and make sure learners sit in a circle, maintain eye contact and talk in turn so that everyone can easily follow the discussion. Encourage learners with hearing impairments to sit at the front of the class. • Learners with physical impairments may need assistance with fieldwork. Arrange transport for them if necessary, or have other group members document their fieldwork observations so that learners with impairments can contribute to other parts of the project.
Suggested teaching time	• Topic 2.1: 15 lessons • Topic 2.2: 16 lessons • Topic 2.3: 15 lessons • Topic 2.4: 13 lessons • Revision and self-assessment: 10 lessons
Additional resources needed	Internet (if available); graph paper; atlases; resource persons; newspaper articles and documentaries on drought (for example, www.youtube.com/watch?v=y-b4wz3y5Zg); news on rainfall and the volume of dams in press

Introduction to this theme

Remind learners of the Theme 2 topics covered in Grades 10 and 11. Try to use atlases as much as possible to improve learners' map-reading skills as well as their general knowledge.

Theme 2 deals with resource extraction and use (including manufacturing), and the socio-economic and environmental impacts associated with these activities. The topics provide learners with the fundamentals needed to understand some of the key opportunities and challenges to social and economic sustainability that we in Namibia, as well as the rest of the world, are grappling with. As such, these topics are closely related to current affairs and to very local issues and challenges. Help learners to see that this content is not abstract, but central to their and their families' lived experiences. Try to give examples that they can relate to, and encourage them to see how each topic relates to their own lives.

TOPIC 2.1 Manufacturing industries

LB pages 96–111

Beginning these lessons

Prior knowledge: In Grades 10 and 11, the focus was on the factors influencing the location of the fishing industry.

This year, learners will look at a wider range of industries – the South African motor vehicle assembly industry, the high-technology industry, and the craft industry – and the factors that influence their locations. This topic also covers the spatial and structural characteristics of small-scale industries, factories and multinational companies. The focus then shifts to the impact manufacturing industries have on Namibia, the environment, and the social and economic aspects of society.

Starter activity

Discuss the questions as a class, while you revise the different sectors of the industrial system and remind learners what they were taught in previous years. Copy Table 2.1.1 in the Learner's Book onto the board and encourage learners to come up with as many examples as they can think of. Erase the table before learners work through the activity by themselves, writing the answers in their exercise books.

Suggested answers

1. Learners' answers may vary, for example:

Primary	Secondary	Tertiary
1. Crop farming 2. Pastoral farming 3. Fishing 4. Mining	1. Flour 2. Milk 3. Canned fish 4. Jewellery	1. Teacher 2. Doctor 3. Plumber 4. Artist

2. The secondary sector, where raw materials are used to manufacture products

3. a) The tertiary sector, as hotels are service businesses

b) The primary sector, as mining extracts raw materials from the Earth

c) The secondary sector, as raw materials such as metals and diamonds are used to manufacture jewellery

Factors that influence the location of manufacturing industries

Teaching guidelines

- Revise the factors that influence the location of manufacturing industries that were covered in Grades 10 and 11. Then, discuss the factors that are new to learners. Use posters or pictures to illustrate the factors and help learners to remember the concepts.
- Learners work through Activity 1 in pairs. Ensure that any learners with visual impairments work with a sighted learner who can describe Figure 2.1.4 in the Learner's Book to them.
- The motor vehicle assembly industry is a prime example of an industry in which all the factors are involved. Spend some time on this topic to help learners understand not only how these factors influence the industry, but also how they influence one another.
- Learners work in pairs to complete Activity 2. Ensure that any learners with visual impairments work with a sighted learner who can assist them.
- High-technology industries cover a wide range of businesses and are therefore less clear cut than simple manufacturing. We focus especially on science and technology parks, where a lot of research and development is carried out. The Namibia Business Innovation Institute (NBII) in Namibia is used as an example, but you can also use examples from Silicon Valley in California as extension.
- The craft industry should be more familiar to learners, since Namibia has a huge tourist market. Encourage learners to suggest relevant location factors before you go through the content in the Learner's Book.
- Learners then work through Activity 3 on their own. However, learners with visual impairments will need to work with a sighted learner who can assist them. You can supply learners with the map on the next page to answer Question 1.

Homework

Activity 3 can be finished at home, if necessary. Ideally, learners should complete Activities 1 and 2 in class, as they are working in pairs.

Suggested answers

Activity 1 (LB page 98)

Learners' answers may vary. Reward logical answers that can be deduced from the map. For example:

1. Building 1
2. Any five of the following:
   - Within walking distance of the beach
   - Enough space for kitchen, tables and chairs
   - Close to the footpath along the beach – easily accessible for tourists who walk down the path and visit attractions such as the craft market
   - Across from the hotel – close and visible to hotel patrons
   - Conveniently accessible for other business owners leasing in the area
   - Front opening visible to people on beach as well as other businesses
   - Near a loading zone

Activity 2 (LB page 100)

Learners' answers will vary. Make sure they motivate their choice of location with reference to the map in Figure 2.1.6 and the factors listed in Table 2.1.2 in the Learner's Book. Encourage learners to add their own insight. Learner's should also consider the location of the parent company in their discussion.

Activity 3 (LB page 103)

1. Learners must use an appropriate key to indicate the following:
   - Teak wood in Zambezi and Kavango
   - Mopane wood in Kunene

- Recycled material in Okahandja
- Bones and horns in Otjozondjupa, Erongo and Kunene
- Necklaces from ostrich egg beads in Omaheke

2. Learners' answers will vary depending on your area and the craft they choose.

Continuous assessment

Go through the answers to Activities 1, 2 and 3 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Spatial and structural characteristics of manufacturing industries

Teaching guidelines

- This section covers both small- and large-scale manufacturing industries. Point out to learners that their family members who craft items at home to sell are also essentially running manufacturing businesses.
- A clear distinction should be made between local factories and the factories of multinational companies that may be located in the country. The vehicle manufacturing industry is a good example of multinational companies that have factories in different countries.
- Discuss the advantages and disadvantages of the different industries and encourage learners to make comparisons between them. For example, ask learners if they would prefer to work in a cottage industry, in a factory or for a multinational company. Then ask them which type of industry they would prefer to own. Use question-and-answer methodology to prompt learners to think about the social, economic and environmental impact of the different types of industries.
- Learners then work in groups for Activity 4. Make sure that learners with hearing impairments are able to participate in the group discussions.

Homework

Ideally, learners should complete Activity 4 in class, as they are working in groups, but they may need to do additional research outside of school.

Suggested answers

Activity 4 **(LB page 107)**

1. and 2. Learners' answers will vary depending on your area and the industries learners identify. Ensure that learners accurately describe the spatial and structural characteristics of the businesses they select. They should recognise that cottage industries are small and have a basic organisational structure. They usually have a small sphere of influence and are often home-based. Factories and multinational companies are increasingly large and complex with many inputs and outputs. Factories and multinationals also have complex locational requirements that are determined by the location of resources, markets and labour as well as by linkages with other industries and services.

Continuous assessment

Walk around the classroom as learners discuss Activity 4. This will give you an indication of which learners require remediation and extension. Make sure that learners understand that spatial characteristics relate to the location of an industry, and structural characteristics refer to the size and organisation as well as the inputs and outputs of an industry. They should be able to demonstrate their understanding of the learning material by applying the theoretical concepts to real-life examples. Learners can mark and correct their own work. You could record their marks for continuous assessment.

Importance of manufacturing industries to Namibia's economy

Teaching guidelines

- Introduce this section by reminding learners that Namibia has a number of manufacturing industries. Ask them to name a few of these, for example, industries related to food processing and packing, such as Namibia Breweries Limited; mining and chemicals production, such as Elso Holdings and Ohorongo Cement; and clothing manufacturers such as Dinapama.
- Before going through the content in the Learner's Book, ask learners whether they think factories can improve Namibians' lives, and how.
- Make sure learners understand how different sectors of the economy are connected to one another.
- Learners then work in their Activity 4 groups again for Activity 5.

Homework

Activity 5 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in groups, but they may need to conduct interviews and do additional research outside of school.

Suggested answers

Activity 5 **(LB page 108)**

Learners' answers will vary depending on your area and the industries learners identified for Activity 4. Learners will need to approach and interview a relevant person at the local cottage industries that they identified in Activity 4. They will need to do Internet research on the factories and multinationals that they identified. Alternatively, they could write to the Namibian Manufacturers Association (NMA) for information. Letters should be addressed to Namibian Manufacturers Association, P.O. Box 3325, Windhoek.

Continuous assessment

Walk around the classroom as learners discuss Activity 5. This will give you an indication of which learners require remediation and extension. They should be able to identify a company's contribution to the economy, and explain the importance and effects of this contribution. Learners can mark and correct their own work. You could record their marks for continuous assessment.

The nature of industrial landscapes and environmental consequences of industrial developments

Teaching guidelines

- Ask learners to describe they ways in which they think industries affect the environment.
- Stress that industrial development is not all good. It is a major cause of global warming and climate change, which are global crises. Climate change is hitting African countries especially hard.
- Invite learners with hearing impairments to the front of the classroom for the debate. Invite the principal or a senior teacher to judge the debate.

Homework

Questions 1 and 2 of Activity 6 can be finished at home, if necessary.

Suggested answers

Activity 6 **(LB page 109)**

1. Learners' answers will vary. For example: Industrial development contributes to climate change, air pollution, soil pollution and water pollution, the destruction of habitats and the loss of vegetation cover. Vegetation – especially forests – is essential to the removal of carbon dioxide from the atmosphere.
2. Learners' answers will vary depending on your area, and on learners' own observations, research and knowledge. Accept any logical, valid answers.
3. Learners' answers will vary. Award marks for any logical opinions. For example:
   Yes, the economic benefits of industrial development are worth the environmental impact:
   - More industries lead to more and better-paying jobs.
   - More industries in LEDCs can improve these countries' economies, and make it possible for them to compete against MEDCs.
   - Improved economies and higher incomes mean that governments can provide more schools and healthcare services, and increase standards of living.
   - It is unfair for less developed countries to sacrifice their economic development due to global warming concerns when they have contributed very few greenhouse gas emissions so far, and more developed countries have been able to develop freely for decades.
   - People and companies are too concerned about money and profit to stop polluting or to slow down industrial development. Other countries, especially more developed countries that are responsible for most emissions, are refusing to move quickly enough and implement regulations that will help us avoid climate change. We need to develop as fast as possible to make sure we can afford to handle the consequences of climate change.
   - New technological developments could slow down pollution, such as improvements in renewable sources of energy, or reverse it.
   - Advances in transport, such as electric cars, can reduce the impact of transport on the environment.
   - Social media makes people more aware of destructive environmental practices, so that we can try to stop them.

- Higher standards of living could reduce other environmental impacts associated with poverty, such as illegal dumping of waste, releasing untreated sewage into rivers, slash-and-burn agriculture, overgrazing and illegal hunting of wildlife.

No, the economic benefits of industrial development are not worth the environmental impact:

- Deforestation and greenhouse gas emissions increase the amount of carbon dioxide in the atmosphere, which results in rising global temperatures.
- We have reached a point where we are already suffering from the consequences of climate change. We have no choice but to move away from industries that emit greenhouse gases, even at the expense of our economy and standard of living. If we do not stop now, we will be much worse off in future.
- Environmental consequences are not just global, but local as well. For example, too many polluted water sources will end up costing the country in the long run, as clean drinking water becomes increasingly scarce.
- The change to renewable sources of energy is too slow to make a difference or counteract the effects of global warming.

Continuous assessment

Discuss learners' answers to Activity 6 as a class. Learners can mark their own work. You could record learners' marks for continuous assessment.

The social and economic implications of industrial change

Teaching guidelines

- Industrial change has many social and economic benefits, but learners must be aware that industrialisation also has negative social and environmental effects.
- Use this opportunity to focus on gender equality and how gender roles are affected by industrial development.
- Learners work through Activity 7 on their own.

Homework

Activity 7 can be finished at home, if necessary.

Suggested answers

Activity 7 **(LB page 111)**

Learners' answers will vary, especially in terms of the examples they use. Make sure they have discussed both the social and economic impact of industrial development. They should consider both positive impacts (such as improved quality of life, better education, and so on) and negative impacts (such as social fragmentation, increasing inequality and higher costs of living).

Continuous assessment

Discuss learners' answers to Activity 7 as a class. This activity not only checks learners' knowledge, but also their ability to sort information in a logical way. The rubric below can be used for marking purposes. You could record learners' marks for continuous assessment.

	Below average	Average	Good	Excellent
Sentence construction and style (writing)	There are few or no full sentences. The essay does not follow a logical sequence.	Not all sentences are complete. The essay lacks logical flow in more than four places.	Full sentences are used. There may be one to four places where the essay does not flow logically.	Full sentences are used and the essay flows logically throughout.
Organisation of information and comparison of advantages and disadvantages	Learners cannot organise the information or formulate their comparisons logically.	Learners' information and comparisons are incomplete *or* do not flow logically.	Learners' information and comparisons are mostly logical.	Learners are able to organise the information and make logical comparisons based on the knowledge they have.
Using examples from real life	Learners give no examples, or only one or two.	Learners give a few random examples.	Learners give examples for most of the social and economic effects.	Learners are able to give examples for all the social and economic effects.

Remedial and extension activities

Remedial

1. Revise terminology on a regular basis with learners in need of support. Obtain images of different industries from the Internet, newspapers or magazines, and ask learners to classify each example as heavy industry (for example, automotive), light industry (for example, textiles), high-technology industry or craft industry. Learners can also say whether they think the industries shown are local or multinational.
2. Divide the class into three groups, ensuring that learners with special educational needs are placed in each group. Allocate a different type of industry to each group: cottage industry, factory or multinational company. Each group must imagine they are starting a business that falls under their given industry type. They must decide what type of product their business manufactures, and give their business a name. Encourage learners to think of businesses in their area or other businesses they have some knowledge of. They can also find ideas by visiting the Community Skills Development Foundation (COSDEF) website, and the Namibian Manufacturers Association (NMA) website, or by looking at lists of Namibian companies online, for example, at https://en.wikipedia.org/wiki/.

   Each group must put together a presentation that covers the following:
   a) The product(s) their business creates
   b) The spatial and structural characteristics of their business
   c) The advantages and disadvantages of the type of industry the business falls under.

   Ask each group to give their presentation to the rest of the class. The presentation can be in the form of a poster or oral. Learners can also bring in an example of the item their business manufactures.

Extension

1. Extend learners' knowledge on deforestation by providing them with a documentary to watch or an article to read, for example, www.nationalgeographic.com/environment/global-warming/deforestation/.
2. Learners can write a report on the positive and negative social and economic impacts of industrial change on people's lives. Encourage learners to use the Internet or local library to find additional information. They can present their case studies to the class.

TOPIC 2.2 Agriculture

LB pages 112–128

Beginning these lessons

Prior knowledge: In Grades 10 and 11, agricultural systems in Namibia and southern Africa were dealt with comprehensively.

This year, the focus is much narrower and deeper. Learners investigate the opportunities and constraints of developing land for agriculture, as well as the accompanying social, economic and environmental issues. The characteristics of different agricultural systems – intensive and extensive; arable, pastoral and mixed – are discussed, as well as the factors that affect them. Agricultural land use is an important issue in a world where hunger and climate change threaten our livelihoods. We look at the advantages and disadvantages of agricultural development throughout this topic. It is important that learners understand that we need economic development to improve our quality of life, but that we should also look after the environment. There is a fine balance that humans should maintain between economic development and the conservation of the environment.

Starter activity

The activity introduces this year's agriculture content. The first question revises knowledge covered in Grade 10 and 11, while the second question should stimulate learners' creativity. The third and fourth questions aim to encourage learners to think about the subject matter and deduce for themselves some of the issues this topic deals with. Use question-and-answer methodology to guide learners to answer the questions on their own.

This activity should be a class discussion. Allow learners to write answers on the board, especially for Question 2, which can be answered in table format. Describe the images in Figure 2.2.1 clearly and simply to help learners with visual impairments understand what they show.

Suggested answers

1. A system is a set of components or procedures that work together or interact over time. The components of a farm are inputs, processes, outputs, and feedback.
2. Learners should mention at least some of the following:
   - **a)** Inputs: Climate, soil, seeds, fertiliser, pesticides, herbicides, water, equipment, labour, skills, knowledge, capital
     Outputs: Crops, seeds for the next season
   - **b)** Inputs: Animal feed, water, sheds, camps, shelters, medicine, vaccines, labour, skills, knowledge, capital
     Outputs: Meat, wool, milk, dairy products, eggs, hides
3. Learners' answers may vary, but should include at least some of the following: Farmers can sell excess produce to make an income, and lift themselves out of poverty; small-scale farms lessen the need for imported food; bigger farms provide employment and income to people in the area; bigger farms have higher yields, some of which can be exported, improving the country's economy
4. If time allows, discuss each illustrated effect. More information can be found on page 125 in the Learner's Book.
   - A. Deforestation is often required to clear land for crops, such as the maize fields in the image.
   - B. Fertilisers, pesticides and other chemical substances used in agriculture can cause eutrophication if they are washed into nearby water bodies. Learners learnt about eutrophication in Theme 1, and should be able to relate how the process occurs and its consequences.
   - C. Overgrazing leaves land bare and exposed to erosion.
   - D. Poor agricultural practices cause erosion.

Opportunities and constraints to consider when developing land for agriculture

Teaching guidelines

- Start this section by asking learners whether they know family or friends who have had to clear land. Encourage learners to explain how and why it was done.

- Go through the opportunities and constraints of agricultural land development. Point out that land is usually cleared to make provision for an economic activity. The three opportunities of agricultural land development go hand in hand: it makes land usable, which enables people to grow food and contribute to food security, as well as to earn an income.
- Stress that we need to develop land for various purposes, such as farming, but that doing so causes environmental harm, which we should try to mitigate. Land development should be limited as much as possible.
- Learners then work through Activity 1 on their own, and Activity 2 in groups of five. Ensure that sighted learners assist learners with visual impairments. Make sure that learners with hearing impairments are able to participate in Activity 2. They may need additional visual cues, so have another group member take notes for them to follow.

Homework

Activity 1 can be finished at home, if necessary. Ideally, learners should complete Activity 2 in class, as they are working in groups, but they may need to do additional research outside of school.

Suggested answers

Activity 1 **(LB page 115)**

Learners should be able to demonstrate solid arguments when comparing the opportunities and constraints. Encourage learners to consider ways to make land development sustainable, for example, by increasing the productivity of existing farmland, improving food storage and distribution facilities, by avoiding marginal land (such as land that is water stressed, is prone to erosion or has poor soil quality) or land that is ecologically important.

Activity 2 **(LB page 115)**

Learners' answers will vary, depending on the area in which they live, and the specific site they have chosen. The motivation for the selected site should be based on the constraints and opportunities discussed in the Learner's Book.

Continuous assessment

Discuss learners' answers to Activities 1 and 2 as a class. The rubric below can be used for marking the Activity 1 essay. You could record learners' marks for continuous assessment.

	Below average	Average	Good	Excellent
Sentence construction and style (writing)	There are few or no full sentences. The essay does not follow a logical sequence.	Not all sentences are complete. The essay lacks logical flow in more than four places.	Full sentences are used. There may be one to four places where the essay does not flow logically.	Full sentences are used and the essay flows logically throughout.
Logical comparison and solid arguments	Learners cannot formulate their comparisons and arguments logically.	Learners' comparisons and arguments are incomplete *or* do not flow logically.	Learners' comparisons and arguments are mostly logical and solid.	Learners are able to make logical comparisons and provide solid arguments based on the knowledge they have.
Drawing a logical conclusion from the arguments	Learners are not able to formulate a logical conclusion, or base it on a few haphazard arguments.	The conclusion is based on only some of the arguments.	The conclusion is based mostly on the arguments provided, but the learner uses new facts or does not use significant arguments provided.	The conclusion follows logically on from the arguments provided.

Physical and human factors that influence decision-making in creating different systems of agriculture

Teaching guidelines

- It is important that learners understand the difference between intensive and extensive agriculture. You can use posters and pictures to clarify these concepts, and to give examples of the different systems in Namibia and Africa.
- Explain to learners that human factors include government officials and consumers in markets, not just the farmers. Land tenure and agricultural policies are determined by the government. Markets are influenced by consumers, and capital refers to the money people have to establish farms. Globalisation has to do with worldwide trends, and scientists and engineers develop technology.
- Learners work in pairs to complete Activity 3, which introduces the concept of tree maps. These are useful ways of breaking down large or difficult sections of work, and makes analysis easy. Before starting the activity, explain to learners how they should structure their tree maps, especially if they have not worked with something similar before. Figure 2.2.17 in the Learner's Book gives them a starting point. Suggest that learners use tree maps for other work or subjects in which things are classified, complex and/or compared. Ensure that any learners with visual impairments work with a sighted learner who can describe the Figure 2.2.16 images to them.
- Divide the class into two groups for Question 1 of Activity 4. Give the learners at least one period to prepare their arguments, while guiding them. Invite the principal or another teacher to attend the debate and choose a winner. You can also get all the learners in the school together to watch the debate. Make sure that learners with hearing impairments are able to follow the debate.
- Learners then complete Question 2 of Activity 4 on their own.

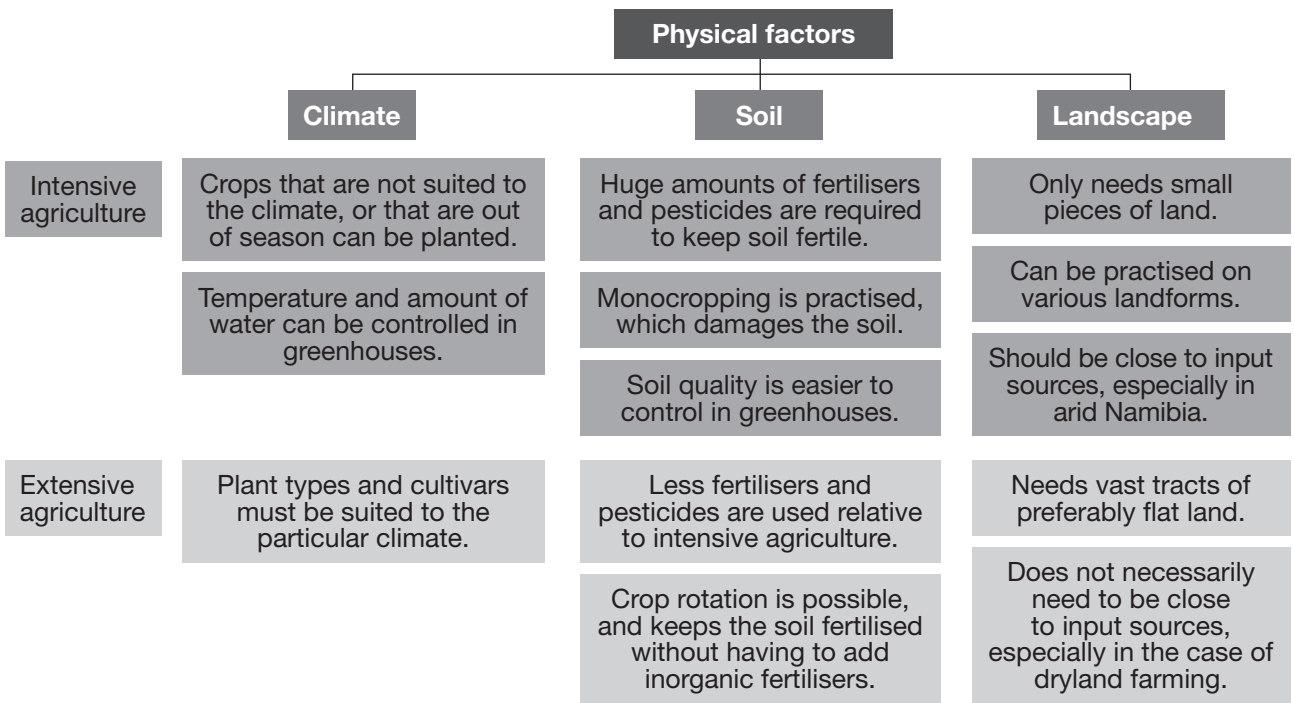
Homework

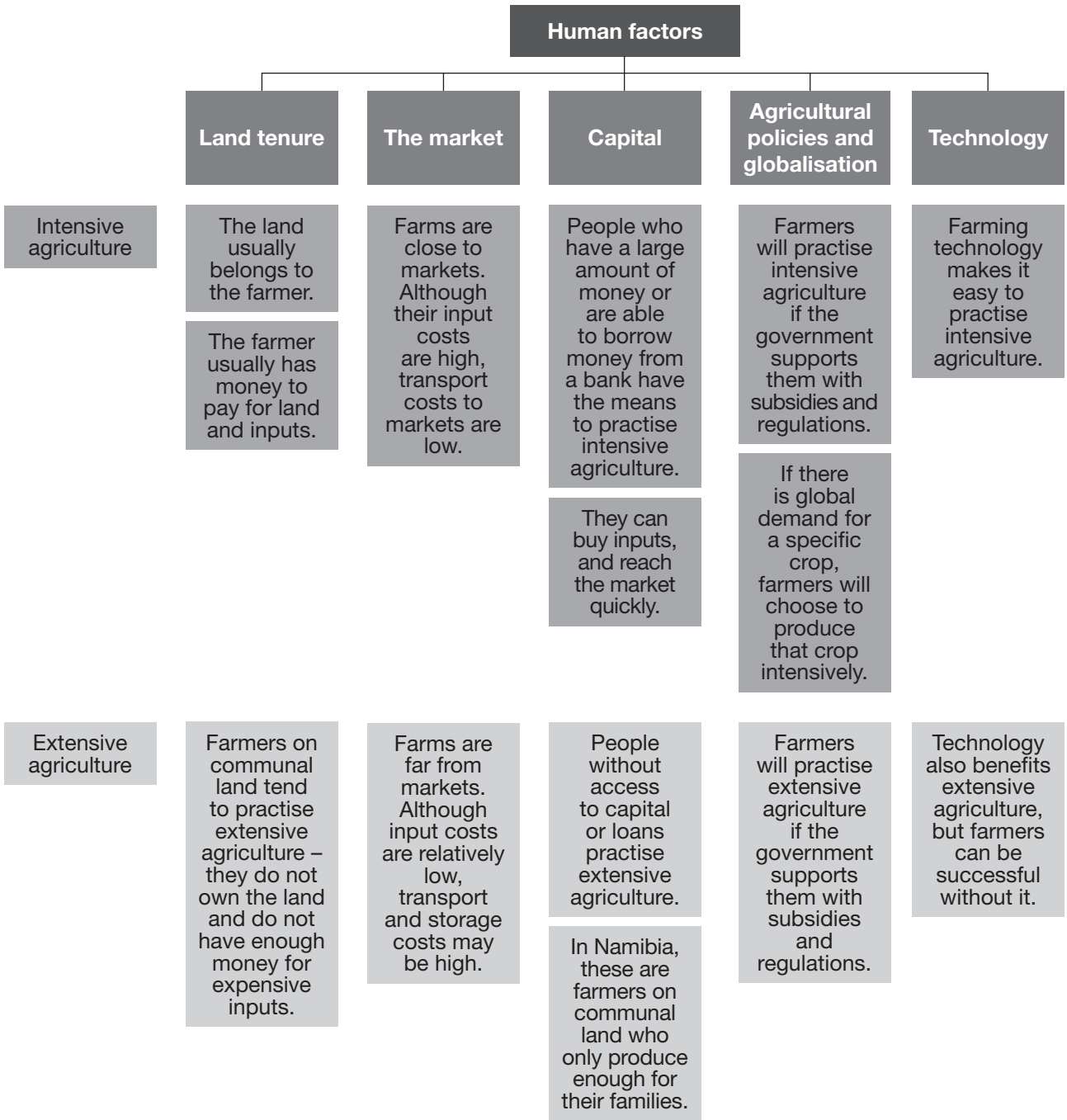
Question 2 of Activity 4 can be finished at home, if necessary. Ideally, learners should complete Activity 3 in class, as they are working in pairs.

Suggested answers

Activity 3 **(LB page 119)**

1. A. Extensive agricultural system
   B. Intensive agricultural system
2. Refer to Table 2.2.1 on page 116 of the Learner's Book for a comparison of intensive and extensive agriculture.
3. Learners' answers may vary. For example:





Activity 4 (LB page 119)

The arguments the learners present must be based on the factors set out in the Learner's Book. Learners must also take into account the nature of their local area and assess whether it would be better suited to intensive or extensive agriculture. Ensure that learners are associating each factor with the correct agricultural system.

Continuous assessment

Discuss learners' answers to Activity 3 as a class. Learners can mark their own work. Walk around the classroom as learners discuss Activity 4. This will give you an indication of which learners require remediation and extension. You could record learners' marks for continuous assessment.

The way in which the inputs and outputs of arable, pastoral and mixed agriculture vary

Teaching guidelines

- Allow learners to take the lead in discussions in this section. Ask them to define arable, pastoral and mixed agriculture. Use posters or pictures to guide them.
- Draw tables similar to those on page 120 of the Learner's Book on the board. Encourage learners to give examples of inputs and outputs of the different systems, and use their suggestions to fill the tables.
- Stress that the inputs and outputs of mixed agriculture form a closed cycle. Describe Figure 2.2.18 clearly and simply to help learners with visual impairments understand what it shows.
- Help learners to organise themselves into three groups of equal size for Activity 5. Learners should ideally choose crops and livestock that are being cultivated and reared in the area where they live. Allow this activity to stretch over two or three days, so that learners can consult farmers in their communities when they need more information. If you have access to the Internet, encourage learners to read up on the inputs and outputs of the specific crops and livestock they have chosen. Ensure that learners with hearing impairments are able to participate in their group's work.

Homework

Ideally, learners should complete Activity 5 in class, as they are working in groups, but they may need to do additional research outside of school.

Suggested answers

Activity 5 **(LB page 121)**

Learners' answers will vary depending on the crops and livestock they choose. Ensure that learners have identified the correct inputs and outputs for their agricultural system. Facilitate the class discussion, and provide supplementary information on specific inputs learners may have overlooked.

Continuous assessment

Walk around the classroom as learners discuss Activity 5. This will give you an indication of which learners require remediation and extension. You could record learners' marks for continuous assessment.

Factors that influence different agricultural systems

Teaching guidelines

- The relevant agricultural systems that could be selected are:
  - » intensive or extensive
  - » arable, pastoral or mixed
  - » subsistence, smallholder or commercial.
- Learners have to know and be able to explain and apply the five factors that determine which agricultural systems farmers would most likely select.
- It may be valuable to choose a few more regions (in addition to the one in Activity 6), so that learners can practise applying the theory of the five factors before they take on the activity. Try to choose examples that would suit different types of farming from Activity 6, for example, a region where intensive commercial arable farming would be the best choice. Since the technology factor is not covered by Activity 6, an example where this is a deciding factor would also be ideal. Alternatively, learners can take on the first extension activity at the end of this topic to learn more about agricultural technology.
- When discussing transport infrastructure, bring in the cross-curricular issue of Road Safety by talking about the importance of well-maintained roads for transporting agricultural produce, and the need to maintain vehicles in good working condition.
- Learners complete Activity 6 in pairs.

Homework

Ideally, learners should complete Activity 6 in class, as they are working in pairs, but they may need to do additional research outside of school.

Suggested answers

Activity 6 **(LB page 123)**

Learners' answers will vary slightly, but the following information must be included:

- The obvious answer is extensive livestock farming on a small scale: subsistence or smallholder pastoral farming, depending on the amount of money the "farmer" has. Many farmers in this region rear cattle, but they also farm sheep and goats. Accept logical answers with good motivation.
- Physical environment: The Omaheke region includes part of the Kalahari Desert, so it

has sandy soil that is not suitable for arable agriculture. However, there is vegetation that can serve as grazing for animals.
- Population density: The Omaheke region does not have a large population, so it is suitable for extensive agriculture.
- Transport: Gobabis, the capital of the Omaheke region, is connected to Windhoek by a main road, the B6. There are a number of roads from several places in the region to Gobabis. This means that equipment and inputs can easily be transported to farms, while meat and livestock can be transported to markets, should farmers have excess produce.

Continuous assessment

Walk around the classroom as learners discuss Activity 6. This will give you an indication of which learners require remediation and extension. Discuss learners' answers as a class. You could record learners' marks for continuous assessment.

The socio-economic and environmental implications of change in agricultural land use

Teaching guidelines

- Changes in agricultural land use have positive and negative implications for society, the economy and the environment. Encourage a class discussion on the benefits and negative effects of agricultural development, and ask learners to come up with possible solutions to mitigate the negative effects.
- It is important that learners realise the seriousness of global warming and climate change, but also that they know that every person can do something to try and turn it around. If you have Internet access, you can search for videos to illustrate this, for example, using the search term "climate change in Chad" brings up the following video: www.youtube.com/watch?v=8l-dhwqd2UM
- Learners work through Activity 7 in groups of five. If learners with physical impairments are not able to visit nearby farms, have them do online research, or arrange for another group member to photograph or sketch the farms visited.

Homework

Ideally, learners should complete Activity 7 in class, as they are working in groups, but they may need to conduct interviews and do additional research outside of school.

Suggested answers

Activity 7 **(LB page 125)**

Learners will need to either visit some farms in their area or do online research on the type of farming carried out in their region. Alternatively, present them with examples of farming systems in Namibia that they could discuss. They will need to apply what they have learnt about the potential impacts of the types of farming that they identify. They should also show an understanding of the local environment and what risks farming could pose to this environment. Give marks for logical arguments and solutions.

Continuous assessment

Walk around the classroom as learners discuss Activity 7. This will give you an indication of which learners require remediation and extension. Discuss learners' answers as a class. You could record learners' marks for continuous assessment.

Methods of increasing agricultural production in low-income countries

Teaching guidelines

- Stress that as a low-income country's agricultural sector grows, so does its economy, which improves the people's quality of life.
- Explain that there are a few ways in which a country's agricultural production can be increased. Farmers must be willing to make changes to increase production, but the government also has an important role to play in supporting farmers.
  - » Farmers can improve agricultural production by using good-quality seeds and seeds that will yield large harvests, and by using or improving irrigation on their farms.
  - » The government is responsible for training farmers, reforming land ownership, and ensuring that infrastructure and conditions are conducive to trade.

» Scientists and researchers develop seeds that produce high-yield crops.
- Learners complete Activity 8 in their Activity 7 groups of five. Ensure that sighted learners assist learners with visual impairments.

Homework
Ideally, learners should complete Activity 8 in class, as they are working in groups, but they may need to conduct interviews and do additional research outside of school.

Suggested answers
Activity 8 (LB page 126)

Learners' answers will vary and follow on from those of Activity 7. The answers should be based on the relevant methods discussed in the Learner's Book. You can encourage learners to do some more research and develop insight into other methods of increasing agricultural production.

Continuous assessment
Walk around the classroom as learners discuss Activity 8. This will give you an indication of which learners require remediation and extension. Discuss learners' answers as a class. You could record learners' marks for continuous assessment.

Conservation agriculture and land management strategies

Teaching guidelines
- Explain to learners that conservation agriculture and land management will play a crucial role in slowing down and reversing climate change.
- Describe the principles of conservation agriculture, which focuses on keeping the soil healthy by disturbing it as little as possible, by permanently covering it with plants or organic matter such as mulch, and by practising crop rotation. Discuss the organisations that promote the use of conservation agriculture in Namibia.
- Explain and describe land management strategies. Stress that the success of these strategies depends on land users, technical experts and the government all working together.
- If you would like to give learners additional information about the United Nations Sustainable Development Goals, you can search for videos and articles on the Internet using the search term "United Nations Sustainable Development Goals", the following video, for example, is ideal: www.youtube.com/watch?v=_62im0hM7Kg
- Learners complete Activity 9 in their Activities 7 and 8 groups of five. Ensure that sighted learners assist learners with visual impairments.

Homework
Ideally, learners should complete Activity 9 in class, as they are working in groups, but they may need to conduct interviews and do additional research outside of school.

Suggested answers
Activity 9 (LB page 128)

Learners' answers will vary depending on the areas in which they live and the farms they have chosen to study. The second question is an opportunity for learners to exercise independent thinking and their evaluation skills. If necessary, you can guide them towards making conclusions. In the third question, they should suggest solutions that are suitable to the type of farming that is practised. For example, pastoral versus crop farming.

Continuous assessment
Walk around the classroom as learners discuss Activity 9. This will give you an indication of which learners require remediation and extension. Discuss learners' answers as a class. You could record learners' marks for continuous assessment.

Remedial and extension activities

Remedial
Copy and complete the table below. Explain how each factor influences decision-making on the different types of agricultural systems. Do research if necessary.

Factor	Intensive or extensive	Arable, pastoral and/or mixed	Subsistence, smallholder or commercial
Population density			
Technology			
Transport			
Politics and culture			
Physical environment			

Suggested answers

Factor	Intensive or extensive	Arable, pastoral and/or mixed	Subsistence, smallholder or commercial
Population density	Intensive agriculture is practised closer to densely populated areas, such as cities and towns, because you do not require a large piece of a land. Extensive agriculture is practised on larger pieces of land further away from densely populated areas.	Pastoral farming requires the lowest population densities, as most livestock require a large amount of natural land for grazing.	Subsistence and smallholder agriculture can be practised on small areas of land, so they are better suited to more densely populated areas. The same applies to intensive commercial farming; extensive commercial farming requires large areas of land, so cannot be practised where there are dense populations.
Technology	Technology is used more in intensive farming than extensive farming. This is because farmers need the best inputs to ensure they have a high yield.	Technology can be used in arable, pastoral and mixed farming.	Commercial farmers will mostly use technology, because it is expensive. Smallholders might be able to afford fertiliser and some implements.
Transport	Good transport infrastructure is required for both intensive and extensive farming. Intensive farmers require rapid access to markets and extensive commercial farmer must travel a long way. Refrigerated vehicles may also be used for things like salad greens.	Transport is equally important in arable, pastoral and mixed farming. The cost of transport is a serious consideration in all three systems.	Smallholder farmers growing cash crops depend on transport to access markets. Transport is an essential and expensive part of commercial farming, because huge amounts of produce have to be taken to markets that are often far away.
Politics and culture	Farmers may choose between intensive and extensive agriculture based on the amount of support the two options receive from the government, as well as things like the cost of labour.	Farmers may choose between arable or pastoral farming, and specific crops and livestock, depending on the amount of support the different options receive from the government. Namibia is traditionally a country where pastoral agriculture has been important, so people might choose to keep livestock for cultural reasons.	Politics can influence commercial farming a lot, especially if the government and world markets prefer certain crops, livestock or products. Commercial farmers also depend on secure land tenure, and access to reliable financial services and stable markets.
Physical environment	The climate, soil and water availability will determine what sort of crops and livestock can be extensively farmed. Intensive farming is more flexible, because it the physical inputs can be adjusted to suit the crops or livestock.	Some climates and soil are more suited to crops than to livestock, and vice versa. The physical environment determines whether farmers can practise arable, pastoral or mixed agriculture.	The physical environment is a critical consideration in subsistence, smallholder and commercial farming.

Extension

1. Divide learners into groups to research agricultural technology developments. Learners can choose between IT advances such as the use of computers and drones, chemical advances in fertilisers and herbicides, new farming methods, and new agricultural machines and equipment. Make sure the groups choose different technologies. Internet pages that can be used include the following:
   - plugandplaytechcenter.com/resources/new-agriculture-technology-modern-farming/
   - globalfarmernetwork.org/issues/agriculture-technology/
   - farmersweekly.co.za/farm-basics/how-to-crop/getting-started-with-hydroponics/
   - technologyreview.com/2016/07/20/158748/six-ways-drones-are-revolutionizing-agriculture/
   - electronics.howstuffworks.com/everyday-tech/10-high-tech-tools-farm.htm

   Learners should describe how the technology is used, and how it can lead to improvements in agricultural output. They should also discuss the advantages and disadvantages associated with each technology, such as its impact on the environment or its impact on people. Learners can present their findings to the class, or design brochures describing the technology and the specifications of the products. Discuss each group's topic in class.
2. Ask learners to read up on conservation agriculture and land management strategies, and how different countries apply these measures. They should note how the strategies are influenced by the climate and the socio-economic context of each country. Learners should also try to identify the strategies and measures that are best suited to Namibia. They can share their findings in a report or presentation to the class. The following websites may be helpful:
   - www.cimmyt.org/news/what-is-conservation-agriculture/
   - www.fao.org/land-water/land/sustainable-land-management/en/
   - www.greenagri.org.za/assets/documents-/SmartAgri/Case-Studies/2.-Case-Study-CA-FINAL.pdf
   - www.farmersweekly.co.za/opinion/by-invitation/why-conservation-agriculture-must-be-promoted-in-sa/
   - www.fao.org/conservation-agriculture/case-studies/lesotho/en/

TOPIC 2.3 Energy and mining

LB pages 129–144

Beginning these lessons

Prior knowledge: Theme 2 (Economic activities and the use of resources) in Grades 10 and 11 covered the different energy sources.

In this topic, learners study trends in world production and consumption of energy, and learn more about the sources of energy and minerals, as well as their impact on the environment. Learners should already know much of the content in this topic.

Starter activity

This activity checks that the learners remember the different forms of energy production that they learnt about in Grades 10 and 11.

Learners can work in pairs to complete the activity. Ensure that any learners with visual impairments work with a sighted learner who can describe the photographs in Figure 2.3.1 to them. Afterwards, hold a class discussion, so that learners can compare responses.

Suggested answers

1. A. Hydroelectric power
   B. Solar power
   C. Wind power
   D. Thermal power production in a coal-fired power station
2. Energy production in a coal-fired power station uses a non-renewable source, whereas energy production using running water, the Sun or wind is based on renewable sources.
3. Learners' answers will vary. Accept any of the following: Nuclear power, biomass/biogas, fuel wood, oil, natural gas, geothermal, waves
4. Energy provision allows for development to take place. Energy provides light and heat. Industries need energy to operate. Many methods of transport are reliant on energy.

World pattern of production and consumption of energy

Teaching tips

- Introduce this section by stressing the importance of energy and how economic development is linked to the provision of energy. Figure 2.3.2 illustrates this link. Ensure that you describe what is shows clearly for learners with visual impairments.
- Briefly describe and explain the various sources of energy. If you find that learners do not remembered these very well, refer to the Grade 10 and 11 Learner's Book for in-depth revision.
- Discuss global production and consumption of energy. Remind learners that production and consumption of energy are accelerating rapidly due to population growth and increased development.
- Learners take on Activity 1 on their own. However, learners with visual impairments will need to work with a sighted learner who can describe Figure 2.3.5 to them.
- Go through the different maps in the Learner's Book to discuss global production and consumption of energy are more depth. Describe these clearly and simply to help learners with visual impairments understand what is shown.
- Learners work through Activity 2 on their own. However, learners with visual impairments may need to work with a sighted learner who can assist them.

Homework

Activities 1 and 2 can be finished at home, if necessary.

Suggested answers

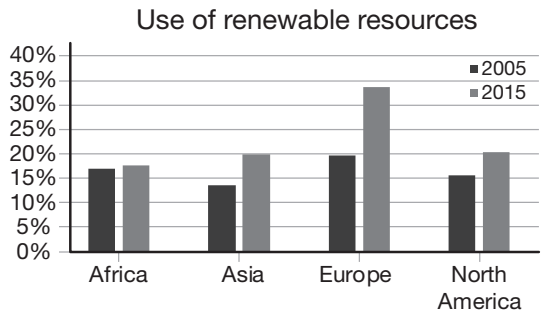
Activity 1 (LB page 131)

1. Petroleum and other liquids, coal, natural gas, renewables, nuclear
2. Petroleum and other liquids, natural gas, coal, renewables, nuclear
3. 2030
4. Learners' answers will vary. Accept any four of the following: Wind power, solar power, hydropower, biomass/biogas, geothermal, waves

Activity 2 (LB page 134)

1. CIS, Latin America, Middle East
2. **a)** Middle East
   b) Oil
3. Learners' answers will vary. Accept any reasonable answers, for example, there is little coal and oil in the region; there are many flowing rivers such as the Amazon River.

4.



Continuous assessment

Go through the answers to Activities 1 and 2 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Factors that affect the demand and supply of different sources of energy

Teaching tips

- Explain that many countries use a combination of sources of energy, which is called the country's *energy mix*.
- Note that a number of factors influence the demand and supply of energy in a country. Then, discuss these factors with the learners using question-and-answer methodology. Grade 12 learners should be able to provide intelligent, informed answers to any questions that you pose to them. Alternatively, divide the class into groups, and have each group discuss factors they think would influence the demand and supply of different energy sources. Learners then report back to the class. Vibrant discussion should be encouraged.
- Learners complete Activity 3 in groups. Ensure that sighted learners describe Figure to 2.3.10 to learners with visual impairments. Make sure that learners with hearing impairments are able to participate in the group discussions.

Homework

Activity 3 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in groups.

Suggested answers

Activity 3 **(LB page 137)**

1. These countries experience very little daily sunlight, for example, less than 1.5 kWh/m^2 daily.

2. Yes, the map shows that this area experiences a lot of daily sunlight, from approximately 4.5 to more than 8 kWh/m^2.

3. This is the Sahara Desert, where skies are free of cloud.

4. Learners' answers may vary. Accept any two suitable answers, for example: Australia, where average daily sunlight ranges from approximately 4.5 to more than 8.0 kWh/m^2 and large areas experience average daily sunlight of more than 8.0 kWh/m^2; the western side of North America, where average daily sunlight ranges from approximately 4.5 to more than 8.0 kWh/m^2.

5. This region is close to the equator and experiences heavy cloud cover and rainfall on most days.

Continuous assessment

Walk around the classroom as learners discuss Activity 3. This will give you an indication of which learners require remediation and extension. Discuss learners' answers as a class. Learners can mark their own work. You could record learners' marks for continuous assessment.

Increasing importance of hydroelectric, fuel wood, wind, solar, biofuels and geothermal power

Teaching tips

- Discuss why the use of renewable energy is increasing. Use the statistics given in the Learner's Book to illustrate the growing importance of renewable energy. Create a mind map showing the reasons for this, using points raised by the learners. Learners can then compare their suggestions with those given on page 138 of the Learner's Book.
- Learners work through Activity 4 in pairs. Ensure that any learners with visual impairments work with a sighted learner who can assist them. If necessary, remind learners how to work out the segment sizes when drawing a pie chart:

1. $\frac{[\text{Percentage}]}{100} \times 360$, for example,

$$\frac{65}{100} \times 360 = 234°$$

2. Ensure that all the degrees add up to 360.

3. Learners should not write on the pie chart itself, but should colour each segment with a different shade and add a key.

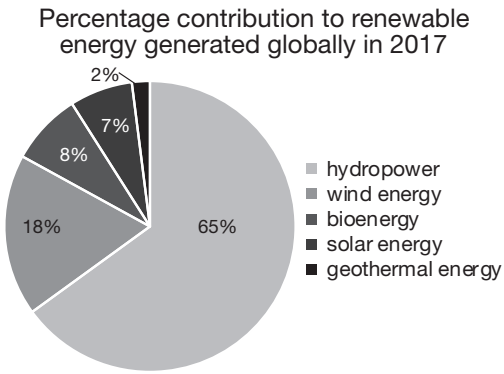
Homework

Activity 4 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 4 **(LB page 139)**

1.



2. a) Learners' answers will vary. Accept any two suitable answers, for example: Angola, DRC, Paraguay, Zambia
b) 70–79.9%
c) Learners' answers will vary. Accept any two suitable answers, for example: Solar, hydropower
d) Learners' answers will vary. Accept any two suitable answers, for example: Mexico, Argentina, Nigeria, Germany, Italy, Turkey, Iran
e) 90–100%
f) Geothermal

Continuous assessment

Go through the answers to Activity 4 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Impacts and consequences of extraction of minerals, energy production and transport on people and the environment

Teaching tips

- Explain the effects of mining, energy production and transport on the environment. Encourage learners to make suggestions and then discuss their suggestions. Use the diagrams, Table 2.3.3 and the case studies in the Learner's Book, as well as any other examples that learners have heard about to illustrate the impact of these activities. Explain acid rain formation and its effects in detail. Describe the diagrams thoroughly, so that learners with visual impairments understand what they show.
- Learners take on Question 1 of Activity 5 on their own. However, learners with visual impairments will need to work with a sighted learner who can describe Figure 2.3.20 to them.
- Learners then discuss Question 2 as a class. Listen to all suggestions made by learners and encourage everyone to participate.
- Go through the case study with the class before learners work through Activity 6 in groups. Ensure that learners with hearing and visual impairments are assisted by their group members.

Homework

Question 1 of Activity 5 can be finished at home, if necessary. Ideally, learners should complete Question 2 of Activity 5 and all of Activity 6 in class, as they are working in groups.

Suggested answers

Activity 5 **(LB page 143)**

1. The countries that generate a lot of hydroelectricity have lower carbon dioxide emissions, for example: between 61 to 80% of Canada's power generation is from hydroelectricity and only 0 to 200 grams of carbon dioxide per kWh is emitted. The same applies to Brazil and Columbia. Countries that generate 81 to 100% of their power from hydroelectricity, for example, Paraguay, the DRC, Norway and Mozambique also only emit 0 to 200 grams of carbon dioxide per kWh. Countries that generate little hydroelectricity have high carbon dioxide emissions, for example, South Africa, India and Australia, where less than 20% of their electricity is generated in hydroelectric power stations. These countries generate more than 801 grams of carbon dioxide per kWh.
The main sources of carbon dioxide emissions with regard to electricity generation is from power stations that burn fossil fuels such as coal, oil and natural gas.

The advantages of hydropower include the following:
- Water is a renewable resource.
- Water is not polluted.
- Very low amounts of greenhouse gases are emitted.
- Dams provide people with other opportunities, for example, fishing, recreation and irrigation.

The disadvantages of hydroelectric power generation include the following:
- When there is less rain, hydroelectricity supply is not constant.
- Valuable land is flooded to build dams.
- River flows are disrupted.
- Vegetation and wildlife are disrupted.

2. a) Learners' answers may vary. Accept any reasonable answers, for example:
- Economic factors: Access to electricity is necessary for development, industry, transport, computers and the Internet, construction, mining, and so on.
- Human factors: Access to electricity is necessary for domestic uses such as cooking, heat and light, mechanised transport, medical facilities such as hospitals, better educational facilities, and so on.

b) Learners' answers may vary. Accept any reasonable answers, for example:
- Yes, small-scale renewable energy sources at a micro-grid and mobile level will provide electricity to people in remote, rural areas, making their lives easier and making Internet schools, communication, mechanisation for subsistence farmers, and so on possible and affordable.
- No, large power plants would be better, as this power would be more reliable. Areas with large populations would have electricity. There will be more power for industry, mining, tertiary services, and so on and therefore the country would become more economically developed.

Activity 6 **(LB page 144)**

1. Learners' answers may vary. Accept any three reasonable answers, for example: Absence of cloud; a lot of sunlight; large space; few human settlements; no other activities in the area

2. a) 601–800 grams per kWh

b) Solar power produces much less air pollution and emissions of carbon dioxide, which will help reduce China's carbon footprint and contribution to global warming, and prevent the formation of acid rain. Energy production will be based on a renewable resource and not on non-renewable fossil fuels. Solar power also does not produce solid waste, does not need water and does not pollute water. It is environmentally friendly and sustainable.

Continuous assessment

Walk around the classroom as learners work in their Activity 6 groups. This will give you an indication of which learners require remediation and extension. Go through the answers to Activities 5 and 6 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Remedial and extension activities

Remedial

Divide learners into groups. Each group must discuss measures that could be implemented in homes, schools and businesses to conserve energy. Groups then report back to the class.

Suggested answers

Schools and businesses can reduce their use of air conditioners, use light sensors to switch off lights, switch geysers off at night/during holidays, use energy-saving fluorescent lights, and so on.

At home, people can switch off lights and televisions if no-one is in the room, reduce the setting on the geyser, use heating only when very cold, use more efficient and energy-saving light bulbs, wash clothes in cold water, and so on.

Extension

1. Learners can investigate new technologies used in energy design and present their findings to the class.

2. Learners can interview people in their community to find out about traditional technologies for keeping buildings warm/cool and for saving on fuel for heating and cooking. Discuss their findings in class.

TOPIC 2.4 Water

Beginning these lessons

Prior knowledge: Topic 2.5 in Grades 10 and 11 covered the utilisation and management of water resources in Namibia, so learners should be familiar with much of the content in this topic. Remind learners of relevant content they learnt in Theme 1 when discussing the hydrological cycle and global warming.

Water and water conservation are issues most of your learners have dealt with recently. Water scarcity is a serious problem that all Namibians face. Learners should be able to apply the content covered in this topic to their everyday life. For example, make use of examples from the area in which you live to highlight the problems associated with water deficiency.

As a basis, learners should have a good understanding of the physical factors that influence rainfall, both globally and locally, and how these determine precipitation patterns in different parts of the world. Make use of multimedia to help learners form a picture of what different rainfall areas look like.

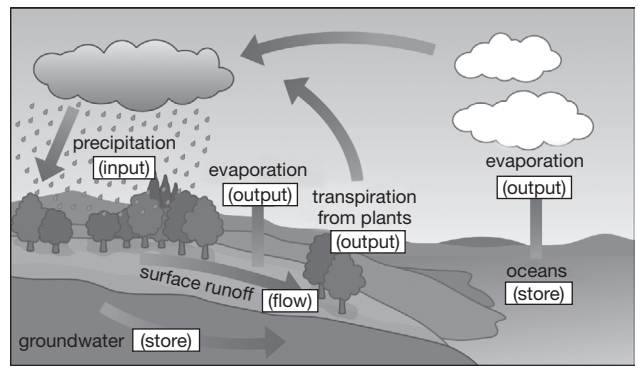
Starter activity

Use this activity to check what learners already know about this topic. Learners should be able to remember what they learnt in Theme 1 and apply their knowledge to these questions.

Learners can work in pairs to complete the activity. Ensure that any learners with visual impairments work with a sighted learner who can describe Figure 2.4.1 in the Learner's Book to them. Afterwards, hold a class discussion, so that learners can compare responses. Encourage them to bring any practical and first-hand experiences into the discussion.

Suggested answers

1. a)



b) Due to insolation from the Sun, water on Earth is heated and turns into a gas (water vapour) in a process called evaporation. Water vapour is also released by transpiration from plants. The warm air containing water vapour rises. As it rises, it starts to cool, until the air reaches dew point temperature and the water vapour condenses to form clouds. The water droplets in the clouds fall to the Earth as precipitation. The precipitation infiltrates into the soil and replenishes groundwater stores. It also enters rivers that run into the ocean and other water bodies.

c) Store

2. Learners' answers may vary, but they should mention at least some of the following: There will be more water runoff and less infiltration due to the abundance of impermeable, artificial surfaces and lack of vegetation. Reduced infiltration increases evaporation rates. There is more precipitation due to pollution and higher temperatures over cities (urban heat islands).

3. Learners' answers may vary, but they should mention at least some of the following:

- Lack of vegetation cover lowers transpiration rates, so fewer clouds form.
- Rapid and increased water runoff as well as a lack of vegetation increases the risk of flooding.
- Reduced infiltration prevents the replenishment of groundwater, which reduces water storage.

- Poor farming methods, such as overgrazing or ploughing with a slope rather than contour ploughing, leads to erosion. Vegetation can then no longer grow due to lack of fertile topsoil, reducing transpiration and rainfall in the area.
- Deforestation also leads to a lack of transpiration.

The distribution of water on Earth; Surplus of water; Deficiency of water

Teaching tips

- Most learners will have experienced years with a rainfall deficit (for example, 2016–2019) and with a rainfall surplus (for example, 2012). Encourage learners to share their experiences of these times, as well as their knowledge of how people in other areas were affected.
- Source newspaper articles from rainy seasons or times of drought to show learners, or ask them to bring in any examples they can find.
- Tell learners they will learn more about the impact of floods and droughts on people in Theme 3.
- Learners work through Activity 1 on their own. This activity allows learners to practise doing research as they will need to find out information about the topography and climatic region of Mawsynram before answering Question 2.

Homework

Activity 1 can be finished at home, if necessary.

Suggested answers

Activity 1 **(LB page 147)**

1.

	Demand for water	Supply of water
Deficiency of water	High	Low
Surplus of water	Low	High

2. a) Monsoon rains due to close proximity to the Bay of Bengal, which is a situated in the warm Indian Ocean. Mawsynram is on the windward side between the Bay of Bengal and the Himalayas.

b) Air converges towards Mawsynram due to the hills surrounding the area. Moisture gets concentrated in the valley between the Khasi Hills where Mawsynram is situated.

c) The main reason that the Namib Desert receives little rain is the influence of the cold Benguela Current from the Atlantic Ocean along the coast of Namibia. Cold ocean currents cause inland movement of cold air. This dense cold air flows below the warmer lighter inland air. This prevents convection currents and clouds from forming. Precipitation in the Namib Desert is mainly in the form of fog. Western Namibia is far from the warm Indian Ocean, so the warm moist air has to travel a long way, and is also blocked by the Drakensberg Mountains. By the time it reaches Namibia, the air is warm and dry. The air becomes increasingly hot and dry, because it has to flow down the escarpment (temperature increases as altitude decreases).

Continuous assessment

Go through the answers to Activity 1 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Reasons why some areas have water surpluses and others have water deficits

Teaching tips

- Rainfall/Temperature graphs from atlases or the Internet can be used to determine which areas should have a water surplus or deficit. Learners can also use their Theme 1 knowledge of how climatic region influences the hydrological system to determine the reasons for water surpluses and deficits. They should look at areas that are normally extremely dry, such as Namibia, and give reasons why there is a deficiency of water in those specific areas. The water supply in important food production and industrial areas of the world can be examined.
- Before going through the content in the Learner's Book, encourage learners to come up with reasons why some areas have water surpluses and others have water deficits. Grade 12 learners should be able to think of most of the reasons by themselves. You could draw a table up on the board to list the physical and human factors learners suggest.

- Describe Figure 2.4.5 clearly and simply to help learners with visual impairments understand what is shown.
- Learners complete Activity 2 in pairs. For Question 3, learners can use maps from old exam papers, or source primary information by going to the area with a well-prepared questionnaire. They could formulate a hypothesis for this question, such as "As industrial development increases, the amount of water used rises". Ensure that any learners with visual or physical impairments work with a sighted learner who can assist them.

Homework

Ideally, learners should complete Activity 2 in class, as they are working in pairs, but they may need to conduct interviews and do additional research outside of school.

Suggested answers

Activity 2 **(LB page 150)**

1. Mainly non-perennial as the rivers are usually dry outside of the rainy season.
2. Learners' answers will vary depending on your area, but most learners are likely to live where there is a water deficiency, as Namibia is a dry country due to the following reasons:
   - It is located on the western part of the continent.
   - The cold Benguela Current brings cold, dry air to Namibia.
   - Both the Kalahari and South Atlantic high-pressure systems are dominant during the winter months.
   - It is located in at a latitude where descending cold air and high-pressure systems are found.
   - The country is far from a warm, rain-bearing ocean.
3. Learners' answers will vary depending on your area. Ensure that their information is correct and well researched.

Continuous assessment

Go through the answers to Questions 1 and 2 of Activity 2 as a class. Make sure that learners' Question 3 presentations are clear and easy to understand. You could record their marks for continuous assessment.

Why areas of water supply and areas of water demand are often different; Problems associated with a scarce water supply; Issues associated with water control and sharing projects

Teaching tips

- Use maps and multimedia throughout these sections. Build on learners' prior knowledge and move into the unknown from there.
- You will need to describe Figure 2.4.11 clearly to help learners with visual impairments understand what is shown.
- Learners should be able to suggest most of the problems associated with water scarcity with little prompting.
- Issues associated with water control and sharing projects will be new to learners. Spend some time on this section and ensure that the learners are familiar with at least two different water control and sharing projects. There are plenty of good examples in Southern Africa but learners can also focus on projects further away from home, such as the National Water Plan in Egypt. It is important to challenge learners at this level to do their own research.
- The Okavango Delta dispute can be used to illustrate just how tense issues of water supply can become in a dry country such as Namibia. Ask learners if they know of any other water disputes. During times of deficiency and drought when there are water restrictions and little water for farming and domestic use, confrontations often break out within communities.
- Learners complete Activity 3 on their own. They could also work in groups for Question 2, which can also be used to discuss positive and negative impacts on the different areas. The questions are based on the case study but will also require further research.

Homework

Activity 3 can be finished at home, if necessary.

Suggested answers

Activity 3 (LB page 155)

1.

Social issues	• Lesotho receives a steady income from the project. This money has been used to improve infrastructure and services in the country. • The construction projects created jobs in Lesotho, and provided many people with an income. • The dry Gauteng province now receives a constant supply of water. • Previously, Lesotho had to rely solely on South Africa for its electricity, but the dam allows for the provision of hydroelectricity. • Infrastructure in Lesotho was improved as more tarred roads were built. • People gained engineering, construction and human resource management skills while working with qualified people from NGOs on the project. • Money that the government received has been lost to corruption, instead of being invested in the country. • Approximately 30 000 people lost their homes and land when the dam basin was flooded, and they complained the money they received in return was not adequate compensation for their loss. • Valuable agricultural land was covered with water. • People drown when the dam levels are adjusted. • The dam causes small earth tremors, damaging local homes. • Medicinal plants were lost during the dam construction. • Downstream of the project, the flow rate of the Orange River has been reduced, resulting in much less water flowing to the drier areas of the Northern Cape. • Migrant labourers working on the projects were accused of sexually abusing local girls, resulting in a rise in teenage pregnancies and STDs, including HIV, in the area. • Communities have been cut off from each other by dams.
Economic issues	• Lesotho receives a steady income from the project. This money has been used to improve infrastructure and services in the country. • The construction projects created jobs in Lesotho, provided many people with an income, and benefitted the economy. • Gauteng province, a centre of industrial and mining activity, now receives a constant supply of water. • The dam provides hydroelectricity. • The Katse Botanical Gardens draws tourists to Lesotho, • Infrastructure in Lesotho was improved as more tarred roads were built. This made it possible for farmers to travel to markets to sell goods. • People gained skills while working on the project. • Money that the government received has been lost to corruption, instead of being invested in the country. • Approximately 30 000 people lost their homes and land when the dam basin was flooded, and they complained the money they received in return was not adequate compensation for their loss. • Valuable agricultural land was covered with water. • The dam causes earth tremors, damaging local homes. • Valuable medicinal plants were lost during the dam construction. • Less water flows downstream to the Orange River where it is used to irrigate Northern Cape vineyards.
Political issues	• Millions of dollars of the money that the Lesotho government received has been lost to corruption.
Environmental issues	• The Katse Botanical Gardens was built to preserve vegetation in the area. • People gained knowledge on looking after the water and protecting it. • Agricultural land was covered with water. • Animals drowned in the initial flood when the dams were created, and continue to be affected by habitat changes. • Animals drown when the dam levels are adjusted. • Natural vegetation was lost during the dam construction, including endangered and valuable medicinal plants. • Downstream of the project, the flow rate of the Orange River has been reduced, resulting in much less water flowing to the drier areas of the Northern Cape.

2. Learners' answers may vary. For example:
   a) There will be water for domestic use, gardens, crop irrigation, recreation (for example, fishing or water sports), and industrial development. People can also fish as a source of food.
   b) There will be water for increased industrial growth, more people will have access to water in their homes, water restrictions can be lifted and mining can continue.
   c) There will be water for increased industrial growth, and enough water for all inhabitants. More goods will be manufactured for export in Port Elizabeth. More jobs will become available as industries grow. Farms in the area will also benefit.

Continuous assessment

Go through the answers to Activity 3 as a class. Learners could debate the answers to Question 2. They can mark their own work. You could record their marks for continuous assessment.

Problems related to water sharing and control

Teaching tips

- Much of the content in this section will be revision. Make use of appropriate images (such as images of erosion, pollution, siltation, mining, and so forth) to keep learners' interest. Encourage them to share their practical experiences with these problems with learners who are less familiar with issues of water sharing. Boreholes are the main source of water in many regions of Namibia outside the rainy season. Ensure that all the learners are actively involved in the discussion.
- In 2020, people were urged to wash their hands multiple times a day for at least 20 seconds to combat the spread of the COVID-19 pandemic. In a country like Namibia, where people must also save water, doing so could lead to a huge increase in daily water usage. Use this example, or a similar recent outbreak, to illustrate the difference that a small change in every individual's water usage can make to the overall availability of water.
- Divide learners into groups of four or five for Activity 4. Each group should be given a specific disease to research for Question 2. Examples include the cholera, malaria, Hepatitis A, diarrhoea and typhoid fever. Question 3 is optional as it could take a lot of time. Assist learners with hearing impairments, and ensure that learners with physical impairments are able to participate in the play.

Homework

Ideally, learners should complete Activity 4 in class, as they are working in groups, but they may need to do additional research outside of school.

Suggested answers

Activity 4 (LB page 157)

1. Learners' answers will vary depending on the area in which they live. Learners living in urban areas will likely mention industrial waste, sewage and so on, while learners in rural areas might list fertilisers, plastic bottles, plastic bags, animal waste, and so on.
2. Learners' answers will vary depending on the outbreak they choose to research. A well-known outbreak was the cholera outbreak in Windhoek and in the Kunene region in 2014 and the hepatitis E outbreak in Windhoek district in 2017. Other potential diseases that may have had more local outbreaks include dysentery, typhoid, polio and malaria.
3. Ensure that learners' plays contain accurate and useful information.

Continuous assessment

Walk around the classroom as learners work in their groups. This will give you an indication of which learners require remediation and extension. Go through the answers to Activity 4 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Remedial and extension activities

Remedial

Ask learners to discuss measures that could be implemented in homes, schools and businesses to conserve water.

Suggested answers

Businesses can set up grey water systems so that drinking water is not used unnecessarily,

use systems that restrict the flow of water, install water-efficient equipment, fix any leaks immediately, educate employees about the importance of saving water, and so on.

Schools can collect water from the basins or kitchen and use it to water the school's vegetable garden (which is part of the government's feeding scheme) or plants.

At home, people can switch off the tap while brushing their teeth, check that taps are closed properly and do not leak, take shorter showers or bath with less water, reuse water when watering the garden or washing the car, plant indigenous vegetation that is suited to the climate and does not require watering, and so on.

Extension

1. Learners can indicate the main Namibian dams and other water supply sources, like the desalination plant near Wlotzkasbaken, on a map.
2. Learners can visit a recycling plant or start their own recycling project at home or at school to help prevent water pollution.

Suggested answers

1. Maps should include the following:
   - Dams:
     - » Central area dams: Swakoppoort Dam, Von Bach Dam, Omatako Dam, Friedenau Dam, Goreangab Dam, Kalkfeld Dam, Omatjenne Dam
     - » Eastern area dams: Otjivero Main Dam, Otjivero Silt Dam, Tilda Viljoen Dam, Daan Viljoen Dam
     - » Southern area dams: Hardap Dam, Naute Dam, Oanob Dam, Dreihuk Dam, Bondels Dam, Neckartal Dam
     - » Northern area dams: Olushandja Dam
     - » Western area dams: Omdel Dam
   - Rivers from which water is extracted: Kunene River, Okavango River, Zambezi River, Orange River
   - Desalination plant: The Erongo desalination plant, which is located near Wlotzkasbaken, north of Swakopmund
   - Learners could also indicate the following towns, where treated waste water is reused: Tsumeb, Otjiwarongo, Okahandja, Mariental, Oranjemund, Swakopmund, Walvis Bay, Windhoek.

Self-assessment (LB pages 160–161)

Topic 2.1 Manufacturing industries

1. They are close to ports, which makes it easy and less expensive to import parts and export vehicles. They do not have to transport vehicles a long way for export. (2)
2. The local market for cars is closer to them, which makes it easy to transport vehicles to dealers. Gauteng is also the economic centre of South Africa. (2)
3. The Namibia Business Innovation Institute (NBII) (1)
4. It is located at the Namibia University of Science and Technology. Science parks focus on research and development, and should have strong links with universities to share research and knowledge. (3)
5. Learners' answers will vary. Accept any five of the following:
   - There is a strong culture of traditional craftmaking.
   - It brings money into areas that lack formal industries, and helps to reduce poverty.
   - It provides jobs and income to women who may be excluded from formal employment.
   - The crafts can be exported, and sold for more money in the foreign currency.
   - Craft industries can be used to promote the country, and to attract more tourists.
   - The craft industry encourages entrepreneurship, and develops useful business skills.
   - The craft industry encourages people to use their traditional skills, and to pass these skills on to the next generation. (5)
6. **a)** The spatial characteristics of manufacturing industries refer to where a specific industry is situated, why it is in that specific location and its reach. (3)

   b) The structural characteristics of manufacturers refer to their size (number of employees, number of factories), their organisation and their operation. (4)

7.

Cottage industries		Factories		Multinational companies	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**	**Advantages**	**Disadvantages**
Learners' answers may vary. Accept any three of the following: • Cottage industries can reduce unemployment and poverty. • Cottage industries keep traditional skills alive. • The government may earn tax on the profits. • They can operate from anywhere. • They have low start-up costs and few regulations.	• Running a cottage industry takes a lot of time and effort, but earns very little profit. • Young people might not always want to continue using traditional skills to earn an income. • When the family is not able to work (for example, due to illness), they cannot earn any money.	Learners' answers may vary. Accept any three of the following: • Factories provide employment opportunities and skills training for many people. • They earn much more in taxes for the government than smaller industries. • Rural factories help prevent rural–urban migration. • They can stimulate the establishment of other local businesses, to provide services the factory needs. • Factories' production costs are low, because they produce high numbers of products.	• They may cause small-scale businesses to close down, because factory machinery can produce goods faster and more cheaply than when they are handmade. • If raw materials become unavailable, the factory has to close down, which can negatively impact a country's economy. • A factory that closes may cause other local businesses (those that provide services to it or to its employees) to suffer or also close down.	Learners' answers may vary. Accept any three of the following: • Multinational companies employ and train large numbers of people across the globe. • They bring forex into the countries in which they operate, and help develop many regions in the world. • They encourage, and often contribute or invest in, the growth of infrastructure in countries where they are located, and bring modern and improved technology into the countries. • Multinational companies encourage industrial development.	Learners' answers may vary. Accept any three of the following: • Mechanised manufacturing can put many people out of employment. • The local labour force usually gets the lower paid jobs. • The aim is to make profits, and the interests of the local people and environment are not always considered. • Health and safety standards are not always met, and bribery and corruption can be a problem. • The products are sometimes sold back to the country, at a high cost. • Many companies exploit the mineral resources of the other countries.

(18)

8. Learners' answers will vary. Accept any five of the following:

- Unemployment decreases as more people are employed in the manufacturing industry.
- Skills improve as people are trained to do specific tasks.
- When people's skills improve, they earn better salaries.
- The more people there are earning higher salaries, the more taxes are paid to the government, resulting in better service provision.
- Research in the manufacturing industry may lead to technological advances in different primary and secondary industries.

- Some of the manufactured products can be exported, which brings foreign money into Namibia.
- Overall living standards improve as people can afford more, better and healthier food, and have increased access to medical doctors and clean water.
- The infrastructure in rural areas improves when industries are decentralised and established in these areas.
- Decentralisation also decreases rural–urban migration.
- The craft industry can employ a lot of people from rural areas, using traditional skills that prevent these skills from becoming extinct. (5)

9. Deforestation is closely linked to industrial development, as trees are felled for logging, mining, and building infrastructure. Deforestation also contributes to climate change.
Industries pollute the air, water and soil. Dumping industrial waste into rivers and oceans disrupts the food chain. In some countries, water in lakes, rivers, oceans and dams has been poisoned to the extent that no marine and aquatic life is found there anymore and human consumption is impossible. (4)

10. Learners' answers will vary. Accept any two related social and economic aspects. For example:

- The taxes the government collects are used to build infrastructure such as schools and hospitals and to provide services such as healthcare and training.
- Better infrastructure because of industrial development enables people to travel or commute and work further away from home. This may have a huge impact on family life: work days are long and children are put in childcare, which can weaken the bonds between parents and children. Smaller family units also move away from the big family unit to work in other cities or countries.
- Better infrastructure due to industrial development improves people's quality of life – they have better roads, railways, transport, housing, shopping centres, and so on.
- In less industrialised countries, people who have previously been unemployed are able earn money in factories. However, the factories prioritise profits over the wellbeing of their workers, and are likely to pay employees lower salaries than what they are worth. This exploits people and limits the amount of money they have.
- Companies often require employees to work long hours to maximise profits. Although people earn decent incomes, they feel a lot of stress and have little free time. This causes stress-related illnesses, which can be fatal, especially if they are accompanied by poor diets due to a lack of time to prepare food. (6) **[53]**

Topic 2.2 Agriculture

11. Clearing land is a huge, difficult, time-consuming and usually expensive task. Equipment such as chainsaws, excavators and bulldozers must sometimes be bought or hired for land clearance. When land is cleared, every tree, shrub, weed, stump and rock must be removed. Land clearance may contribute to droughts and climate change. Southern African countries struggle with drought and increasingly erratic rainfall, including flash floods. Changing weather patterns worsen these disasters. Removing vegetation increases the risk of flooding and contributes to global warming.
The soil quality may be poor. Soil covered with natural vegetation is not necessarily fertile. It is best to have a soil analysis done before you start planting crops. Countries in southern Africa struggle with soil erosion. (9)

12. a) Different crops require different climatic conditions. If you decide to use an extensive agricultural system, you have to plant the types and cultivars of crops best suited to the particular climate. Some intensive agricultural systems enable farmers to grow crops that are not necessarily suited to the climate, or they can grow them out of season. In these cases, they use greenhouses, where the temperature can be controlled, and irrigation systems, which control the amount of water. (3)

b) Capital allows farmers to buy land, machinery, seeds and inputs to grow crops successfully. People who have a large amount of capital or who can borrow money from a bank are more likely to practise intensive agriculture. They are able to pay for more inputs, get a high yield relative to the size of the land they use, and are able to reach the market quickly to obtain good prices for their produce. The money they earn is invested in the land and used for more inputs.
Farmers who do not have large amounts of capital or who cannot borrow money from the bank are not able to set up intensive agricultural systems. This is mostly the case with farmers on communal land in Namibia. Many are only able to plant enough crops for their own use. (5)

13.

Socio-economic implications of changes in agricultural land use	Environmental implications of changes in agricultural land use
Learners' answers will vary. Accept any five of the following: • Land development for subsistence agriculture enables families to produce their own food. • If a subsistence farm develops into a smallholder farm, where there is excess produce the family can sell, they can earn an income. • Subsistence and smallholder farms lessen the need for imported food. • When people are able to grow their own food and earn an income from selling produce, their quality of life improves. It may lift them out of poverty and enable them to pay for healthcare and education for their children. • Bigger farms and commercial farms employ labourers. This provides employment to people in rural areas who would otherwise not have jobs and an income. However, farm owners may exploit their labourers and pay them too little. Labour laws need to safeguard workers' rights, and workers need to be educated to ensure they know their rights. • Farmworkers learn skills that could eventually get them better jobs or allow them to run their own subsistence plots or smallholder farms. • Bigger farms have higher yields. If the yield is great enough, some of the produce can be exported. This improves the country's economy, because it receives foreign money.	Learners' answers will vary. Accept any five of the following: • Converting forests and natural vegetation into farmland destroys the habitats of animals and insects. Their numbers will decrease and the biodiversity of the area will decline. • Land development removes trees, increasing the amount of carbon dioxide in the atmosphere. This contributes to global warming. • The soil is usually not fertile enough for crops and requires fertiliser, which can pollute nearby water bodies, causing eutrophication. • Soil that is left bare after land clearance is easily eroded. This makes it impossible to grow crops, and increases the sediment that ends up in rivers, thus increasing the risk of water pollution and flooding. • Soil erosion is a major contributor to desertification. • Although irrigated agriculture uses river water, farmers also sink boreholes, and this decreases the groundwater. The water table may be completely depleted.

(10)

14.
- Keep mechanical soil disturbances (for example by tilling) to a minimum.
- Permanently cover the soil with organic matter.
- Practise crop rotation. (3)

15.
- Governmental policy and institutional support for farmers that helps them adopt sustainable land management strategies, while still generating an income
- Approaches that follow the lead of land users and allow for their participation
- Integrating the use of natural resources
- Involving land users, technical experts and the government, and building partnerships between these stakeholders (4)

16. Learners' answers will vary. Accept any three of the following:
- It explains ways of handling animals that limits the animals' stress.
- It teaches farmers how to adjust livestock numbers so that they do not have too many animals for the available fodder.
- It explains how to market livestock.
- It helps with solutions to rangeland conflict, and management practices.
- It encourages farmers to make furrows for sowing seeds by ripping only the necessary soil rather than tilling it, and helps them analyse the benefit to the soil. (3) **[37]**

Topic 2.3: Energy and mining

17. Developed countries use more energy.
Demand: These countries have a higher demand for electricity as industrialised countries require large amounts of heat and electricity for industrial processes, as well as electricity for offices and shops. There is more extensive transport infrastructure and many different forms of transport, most of which require energy, for example, oil to produce petrol for cars, diesel for trucks and trains, kerosene for aircraft, and heavy oil for ships. Agricultural activities and machines require oil, diesel and petrol. People in developed countries demand a higher standard of living and can afford to pay for electricity. Domestic users in these countries require electricity to power appliances, and use electricity for air conditioning and ventilation.
Supply: Developed countries have advanced technology to generate renewable energy, for example, to convert solar energy into electricity, and for building and maintaining wind turbines. A country's financial resources influence its energy supply. More developed countries have the money for the construction of hydroelectric and nuclear power stations, and the installation of solar and wind energy systems. (10)

18. **a)** Advantages: Clean form of energy in terms of greenhouse gas emissions; little raw material (uranium) is used to produce large amount of energy
Disadvantages: Nuclear waste remains radioactive for many years; small danger of accidents and radiation leaks (4)

b) Thermal energy using coal (1)

c) A. Hydroelectric power (1)
B. Solar power (1)
C. Wind power (1)

d) Wind turns a rotor (blades) that drives turbines, which convert the energy of the wind into mechanical energy. Mechanical energy is converted into electricity by a generator. (2)

19. Solar home systems might consist of a small hot-water geyser on the roof, and a small photovoltaic system comprised of one or two panels that generate a small amount of electricity, which is stored in a battery. People will be able to have hot water, light their homes, power a small radio or TV, cook, charge mobile phones and use a computer and the Internet, if there is signal. (6) **[26]**

Topic 2.4 Water

20. Namibia has a deficiency of water. This means that the rate of evapotranspiration is greater than the amount of precipitation and that the demand for water is greater than the supply of water. (3)

21. Learners' answers will vary. Accept any five of the following:
- Livestock do not have enough grass to eat.
- Cattle die due to lack of food.
- There is not enough water to irrigate crops.
- People face famine because of the lack of livestock and crops.
- Food needs to be imported to sustain people and animals.
- The country could go into debt in order to supply people with basic needs.
- There is insufficient sanitation, leading to the spread of diseases such as cholera.
- Poor nutrition, economic losses and lack of basic needs slow industrial growth.
- Construction of infrastructure slows down, as there is not enough water.
- There is slow economic growth due to lack of industrial development and infrastructure. (5)

22. Learners' answers may vary. Accept any suitable answer, for example:
The Lesotho Highlands Water Project is a shared water project between South Africa and Lesotho to build dams and divert water from the Drakensburg Mountains in Lesotho to improve South Africa's water supply. Lesotho receives an income from the scheme and a hydroelectric power plant was also built to supply the country with renewable energy. (4)

23. a) South Africa, Botswana, Lesotho, Namibia (4)

b) The Drakensberg Mountains (1)

c) Oranjemund (1)

d) Learners' answers will vary. Accept any of the following: Vaal River, Caledon/Mohokare River, Fish River, Molopo River (the Nossob is a tributary of the Molopo; both are non-perennial) (1)

e) i) Learners' answers will vary. Accept any three of the following or other suitable answer:

- Too much water is abstracted from the river upstream, which results in too little water reaching people downstream who are also dependent on it. It lowers the water table in the area as well.
- Fertilisers used in farming increase the phosphate and nitrate levels in the river, which could lead to eutrophication.
  Soil erosion in upstream areas cause silting of the river, stopping water from moving downstream.
- The Vaal River flows through the gold mines in Johannesburg. Toxic chemicals used in mining can pollute the river.
- There are many industries in Gauteng that use water and release polluted water back into the Vaal River.
- There are millions of people living in Gauteng, many of them in informal settlements. Inadequate sewerage infrastructure causes the disposal of waste water into the river, lowering the water quality downstream of the area. (6)

ii) Learners' answers will vary. Accept any two of the following or other suitable answer:

- Building of the Lesotho Highlands Water Project to compensate for the over-abstraction of water from the river
- Proper waste and sewage management by the Gauteng Municipality to prevent pollution of the Vaal River
- Removal of silt to prevent river blockages and improved farming practices to reduce soil erosion
- Water restrictions to prevent the over-abstraction of water in urban and industrial areas
- Environmental laws that are enforced to prevent industrial and mining waste water from polluting the river and its tributaries. (4) **[29]**

Total: 145 marks

Theme 3 Human geography

Syllabus coverage	See the year plan in Section B (pp. 11–16)
General objectives	**Topic 3.1: Population studies** • Understand population dynamics and their social, economic and environmental impact • Understand the influence of population growth in relation to food supply **Topic 3.2: Population movements (migration)** Understand the dynamics of population movements **Topic 3.3: Settlement studies** Understand the dynamics of rural and urban settlement and the process of urbanisation
Specific objectives	The specific objectives are listed in the year plan in Section B in this Teacher's Guide and at the beginning of each topic in the Learner's Book.
Cross-curricular issues	• Environmental Learning: Topics 3.1–3.3 • Population Education: Topics 3.1–3.3 • Gender Issues: Topics 3.1 and 3.2 • Education for Human Rights and Democracy: Topics 3.1–3.3 • HIV and AIDS: Topic 3.1 • Information and Communication Technology (ICT): Topic 3.3 • Road Safety: Topic 3.3
Inclusive education	• Learners with visual impairments need assistance with understanding diagrams, maps and photographs. • Provide documentaries to help learners with visual, physical and/or learning impairments. • Learners with hearing impairments need to be accommodated during group work activities and class discussions. Encourage learners with hearing impairments to sit at the front of the class. • Learners with physical impairments may need assistance with fieldwork. Arrange transport for them if necessary, or have other group members document their fieldwork observations so that learners with impairments can contribute to other parts of the project.
Suggested teaching time	• Topic 3.1: 23 lessons • Topic 3.2: 13 lessons • Topic 3.3: 24 lessons • Revision and self-assessment: 10 lessons
Additional resources needed	Internet (if available); colour pencils; graph paper; atlases; town/city maps; map of immediate area around school; questionnaires; resource persons, particularly local municipal authorities for information on urban developments; variety of multimedia

Introduction to this theme

Human geography has been covered every year since the Junior Secondary phase, but do not assume learners are entirely familiar with the subject and its terminology. Make use of the given key words for revision where necessary. Most learners find this theme very interesting and enjoy researching topics on population.

Remind learners that during examinations they must do the following:

- Refer to the case studies when they need to give "an example from an area that they have studied".
- Specify whether they will be discussing an MEDC or an LEDC when asked "either from an MEDC or LEDC, name and discuss an area…". (They could lose up to 100% of the marks if they do not specify this.)

TOPIC 3.1 Population studies

LB pages 164–188

Beginning these lessons

Prior knowledge: Most of the issues in this topic have been covered in detail in Grades 8 to 11. Learners should also by now know how to interpret population pyramids and the demographic transition model.

This topic looks at the patterns of where people live, and why people live and work in remote areas of the world, which learners usually find very interesting. Keep in mind, however, that learners in rural areas might find it challenging to imagine places where you can find millions of people living together in a small area. Where necessary, illustrate these types of unfamiliar ideas using photographs and the Internet. Ensure that all formulas are memorised and that learners are able to apply them.

The unequal distribution of food supplies is also discussed in this topic.

Starter activity

Learners work through this activity on their own. The questions are designed to test prior knowledge and revise key words. Afterwards, hold a class discussion, so that learners can compare responses.

Suggested answers

1. Population distribution is how people are spread out over a particular area.
2. Learners' answers will vary. Accept any four of the following or any other logical response:
   - Pleasant climates attract more people than areas that receive too little rain, or are too cold or hot.
   - A good water supply is important to a settlement. Dry areas seldom have high populations.
   - Flat areas are easier to build and farm on, so mountainous regions are less populated.
   - Resources like minerals and fossil fuels will attract people to an area.
   - People prefer to live in areas with good services and infrastructure.
3. Population density is the number of people living in an area per square kilometre.
4. Learners' answers will vary. Accept any three of the following or any other logical response:
   - People settle along rivers such as the Kavango River for food and water.
   - People settle in remote areas such as Rosh Pinah for mining jobs.
   - People can now settle in dry coastal areas such as Swakopmund, because desalination technology is available.
   - There are also historical reasons that caused people to settle in Namibia's inhospitable regions. For example, competition for land in East Africa drove the Herero people to move into Namibia in the 1600s. Groups such as the Khoisan were pushed north by the Boers in South Africa.
5. Learners' answers will vary.

The difference between population distribution and density

Teaching tips

- Much of what you teach in this section will be revision. Use question-and-answer methodology to check where there are gaps in learners' knowledge. Encourage all learners to participate.
- Make use of atlases as well as the various population maps in the Learner's Book (see pages 151, 165, 172 and 230) to help learners connect population density and distribution.
- You will need to describe Figure 3.1.2 in the Learner's Book clearly to help learners with visual impairments understand what is shown.
- Ensure that learners memorise the formula for population density.
- Use the appropriate terms as much as possible during teaching time. Once the learners can use population terminology as part of everyday thinking and reasoning, they will be able to answer the questions with confidence.
- Make sure learners understand that factors that influence population distribution and density can be at odds with one another. For example, if a resource is valuable enough, people will settle

nearby to extract the resource, even if the area is otherwise unattractive. People will also still move to cities for their opportunities, services and infrastructure, even if these cities are known to be water deficient.

- Learners complete Activity 1 in pairs, preferably in no more than 20 minutes. Ensure that any learners with visual impairments work with a sighted learner who can assist them. For Question 4, learners will need to calculate the area of your school and town. They can do this from a plan of the school and a map of the town. If you cannot access a map, the area of each can be estimated by multiplying the length and breadth of each, using a suitable unit of measurement. You may need to remind them how to calculate area of regular and irregular shapes beforehand, and go through an example with them. (Theme 4 covers area calculations.) Learners will also need to find out how many learners are enrolled at the school, and how many people live in the town. Information about your town can be obtained from the local council or the Namibia Statistics Agency. Learners then follow the given formula to determine population density.

Homework

Activity 1 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs, but they may need to do additional research outside of class.

Suggested answers

Activity 1 (LB page 168)

1. a) Learners' answers will vary depending on where you live. Make sure they correctly identify the area and whether it is densely or sparsely populated.

b) Learners' answers will vary. Accept logical responses referring to physical or human factors. For example:

- Oshakati, Oshikango and Rundu are densely populated as they are near perennial rivers, which provide food and water and irrigation for crop farming.
- Windhoek is densely populated because it is the capital city, offers many services (such as tertiary education) and offers the most employment opportunities. This is the case on a smaller scale for towns like Swakopmund, Walvis Bay, Rehoboth, Gobabis, Keetmanshoop and Opuwo. Windhoek and Rehoboth are also centrally located and their higher altitudes make them a bit cooler than regions in the north, east and south.
- Areas in the south and west of Namibia are sparsely populated because they have a desert or semi-desert climate, and so have little water or vegetation, making them unsuited for dense habitation.

2. Walvis Bay is densely populated due to its fishing industry and port, which bring many migrant workers into the area. These led to the development of other industries and services such as schools, hospitals, shopping centres, and so on.

3. With modern technology, basic requirements can be brought into the area. This is usually expensive, so people do not usually settle in hostile environments, unless there is another attractive factor that outweighs this issue. Water can be transported via pipelines from far off sources, and can even be pumped over mountainous areas. Roads and other transport infrastructure can bring in food, as well as other commodities such as clothing, cars, computers, and so on. Building material can be brought in as well, so that houses, shops, schools, and so on can be erected. Long distance can be covered by air travel.

4. Learners' answers will vary depending on where you live.

Continuous assessment

Walk around the classroom as learners discuss Activity 1. This will give you an indication of which learners require remediation and extension. By the end of this section, learners should be familiar with the distribution and density of the Namibian population. They should know the main reasons why some areas are densely or sparsely populated as well as why the population distribution is uneven. Discuss learners' answers as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Factors that influence population growth

Teaching tips

- Learners must be able to describe factors that influence low population growth and high population growth. Key words are vital for understanding these different factors and should be used as much as possible. Learners should be able to use the terminology with ease by the end of this section.
- Ensure that learners not only know the theory but can also apply their knowledge to real-life situations and countries. This can be achieved by studying as many different countries as possible, especially countries with different economic backgrounds. Your aim is to make sure that any questions posed in the examinations will be familiar to learners.
- Use this section to discuss the Gender Issues cross-curricular issue and how reproductive rights and choices influence population growth.
- Learners work on their own for Question 1 of Activity 2, and in pairs for Question 2.

Homework

Question 1 of Activity 2 can be finished at home, if necessary. Ideally, learners should complete Question 2 in class, as they are working in pairs.

Suggested answers

Activity 2 **(LB page 170)**

1. a) iii
b) v
c) ii
d) i
e) iv

2. a) 17 − 11 = 6
b) The fertility rate is above replacement level fertility, as the number births exceeds the number of deaths in a year. However, if the rate of emigration is higher than 6 people per thousand, this fertility rate will not be above replacement level.

Continuous assessment

Discuss learners' answers to Activity 2 as a class. Learners can mark their own work. You could record learners' marks for continuous assessment.

The link between population and development

Teaching tips

- The impact of population growth and migration on a country should be highlighted throughout this section.
- Ensure that learners memorise the formulas for natural population growth and growth with migration.
- You will need to describe the maps and graphs in this section clearly to help learners with visual impairments understand what is shown.
- Population pyramids and the demographic transition model form the basis of understanding changes in population, population growth and levels of development. Learners should be able to determine the population structure of a country based on its population pyramid, and link it to the stage of development on the demographic transition model.
- The social and economic status of a country can be inferred from the shape of its population pyramid and the associated stage in the demographic transition model.
- Learners take on Activity 3 on their own. However, learners with visual impairments will need to work with a sighted learner who can describe the graphs in Figure 3.1.11 to them.

Homework

Activity 3 can be finished at home, if necessary.

Suggested answers

Activity 3 **(LB page 177)**

1. a) $\frac{(12 - 6)}{10} = 0.6\%$
b) Increasing
c) It is an MEDC, as both birth and death rate are low.
d) $\frac{(12 + 18) - (6 + 2)}{10} = \frac{30 - 8}{10} = \frac{22}{10} = 2.2\%$
e) Increasing

2. a)

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Base	i) Broad ii) Rapidly decreasing	i) Broad ii) Decreasing	i) Less broad iii) Stable	i) Narrowing ii) Widens towards age 15	i) Narrow ii) Widens towards age 15
Middle	i) Narrowing ii) Very rapidly decreasing	i) Narrowing ii) Rapidly decreasing	i) Slightly narrower than base ii) Slowly decreasing	i) Wider than base ii) Decreasing slightly	i) Wider than base ii) Widening towards top
Top	i) Very narrow ii) Low life expectancy	i) Narrow ii) Increase in life expectancy	i) Wider ii) Higher life expectancy	i) Broad ii) High life expectancy	i) Very broad ii) Very high life expectancy

b) In Stage 3, the pyramid still has a broad base due to natural population increase, but birth rates are dropping so the base is stabilising. Death rates have dropped, so people are living longer and the pyramid therefore has a broad top. These changes are occurring as a result of improved medical care, improved family planning and access to contraceptives, increasing industrialisation and modernisation, and better education and work opportunities for women.

c) i)
- Not enough young adults to replace the working-age population, and too few workers to support the retired population. This means a high dependency ratio between the older population and the working-age population.
- The demand for healthcare services increases as older people have a higher need for these services.
- Not enough old-age homes to care for the elderly.

ii) Learners' answers may vary. Accept any good ideas, for example:
- Provide incentives to have more children and invite young adults from other countries in with well-paid jobs.
- Convert schools into retirement homes.
- Focus on improving the health of the older population.
- Replace certain jobs with machines.

Continuous assessment

Go through the answers to Activity 3 as a class. Learners can swap books and mark one another's work. You could record their marks for continuous assessment.

Overpopulation, underpopulation and optimum population

Teaching tips

- Again, use the relevant terminology as much as possible throughout this section. Repeatedly ask the learners to define key words to ensure that they are familiar with them.
- Make sure that the structure of exam questions relating to this topic is familiar to your learners. Learners often answer incorrectly during examinations because they do not understand exactly what is being asked.
- Ensure that learners do not confuse densely populated areas with those that are overpopulated. Some overpopulated areas may be densely populated as well, but there are plenty of overpopulated areas that have relatively sparse populations – these areas simply cannot support even very few people.
- Learners complete Questions 1, 2 and 3a of Activity 4 on their own, and Question 3b in pairs.

Homework

Questions 1, 2 and 3a of Activity 4 can be finished at home, if necessary. Ideally, learners should complete Question 3b in class, as they are working in pairs.

Suggested answers

Activity 4 **(LB page 179)**

1. **a)** An optimum population is when the people in an area or country work efficiently with the available resources to produce high economic returns for the people living in that area or country, which translates into higher living standards and a better quality of life.
   b) No. Namibia's population is increasing fairly rapidly, but Namibia is mainly desert and water scarcity is a serious problem. Farming is difficult, as rain is not always assured. Namibia has to import most of its food. This means that Namibia cannot support a large population. It is possible that technological developments could increase the carrying capacity in Namibia, but the lack of fresh water remains a major obstacle to increasing the country's carrying capacity.
2. Accept any suitable answers. Examples include improved education, increasing the literacy rate, promoting gender equality, providing high-quality services and healthcare.
3. **a)** Illiteracy, low education levels, poverty and gender inequality all contribute to high fertility rates. This, combined with declining death rates, results in high population growth rates and, potentially, overpopulation.
   When a country becomes overpopulated, it cannot supply the people with enough food, water, housing and jobs. Low income levels, general poverty, poor living standards and high unemployment rates result.
   b) Educate people on family planning, distribute free contraceptives, and promote equal education for women.

Continuous assessment

Go through the answers to Activity 4 as a class. Learners can swap books and mark one another's work. You could record their marks for continuous assessment.

The recent rapid increase in the world population

Teaching tips

- There are some interesting graphs available on the Internet on the increase in the world population. If possible, make use of them to keep learners engaged with this section.
- Describe Figure 3.1.12 clearly to help learners with visual impairments understand what it shows.
- Learners take on Activity 5 in groups. Give each group a different area of Namibia to research, for example, Windhoek, Walvis Bay, Swakopmund, Ondangwa or Rehoboth. Learners should make use of maps and present their data using tables, graphs and images. Ensure that learners with visual and hearing impairments are assisted by their group members.

Homework

Ideally, learners should complete Activity 5 in class, as they are working in groups, but they may need to conduct interviews and do additional research outside of school.

Suggested answers

Activity 5 **(LB page 181)**

Learners' answers will vary depending on the area that they research. Their report should address socio-economic problems associated with limited job opportunities or a lack of arable farm land, as well as problems relating to service provision. Environmental problems could include land degradation in rural areas, over extraction of resources, such as fish and wood fuel, increased pollution, including pollution of valuable fresh water supplies, and loss of habitats for plants and animals.

Ensure that their information is correct and well researched, and that both socio-economic and environmental problems are included.

Continuous assessment

Walk around the classroom as learners work in their groups. This will give you an indication of which learners require remediation and extension. Make sure that learners' presentations are clear and easy to understand. You could record their marks for continuous assessment.

The unequal distribution of food supplies in relation to population

Teaching tips

- The section presents the opportunity for a wide variety of discussions, for example, the advantages and disadvantages of genetically modified (GM) foods, or the development of alternative food resources such as insects for protein.
- Discuss learners' knowledge of traditional farming methods and food supply compared to modern methods. The differences in the diets of rural Namibians compared to those living in urban areas can be discussed, and whether either can be described as a healthy diet.
- Learners work through Questions 1, 2 and 3 of Activity 6 on their own, and Question 4 in pairs.

Homework

Questions 1, 2 and 3 of Activity 6 can be finished at home, if necessary. Ideally, learners should complete Question 4 in class, as they are working in pairs.

Suggested answers

Activity 6 (LB page 185)

1. Technology that is both affordable and applicable to the local population.
2. Learners' answers may vary. Accept any examples of agricultural tools, for example: hoes, ploughs, tractors, harvesting machines, various irrigation systems, and so on.
3.
   - Educate farmers about sustainable farming practices, such as crop rotation, so that they make better use of farmland.
   - Improve roads to and from market areas to lower transport costs and make markets more accessible to local farmers, who will accordingly increase food production, knowing that their crops will be sold.
   - Introduce modern farming methods to increase yields, such as pest- and drought-resistant seeds.
   - Introduce affordable technology that is suited to the local people and climate.
   - Provide farmers with government loans and grants.
   - Irrigate during dry seasons.
4. A minimum of 1 200 calories per day. It should contain a correct balance of protein, carbohydrates, fats, fibre, vitamins and minerals. Ensure that learners' information is correct and well researched.

Continuous assessment

Go through the answers to Activity 6 as a class. Learners can swap books and mark one another's work. Make sure that learners' presentations are clear, colourful and easy to understand. Learners should speak confidently and make use of graphs, pictures or multimedia. You could record their marks for continuous assessment.

Japan and Namibia's population policies

Teaching tips

- Go through the case studies with the learners.
- Learners complete Questions 1, 2 and 3 of Activity 6 on their own, and Question 4 in pairs.
- Find other population pyramids in an atlas or on the Internet, so that learners can practise comparing pyramids. Teach the learners to do this in table form and practice this type of answer as much as possible. Learners often lose marks in the examinations because of incorrect comparison. Give learners the following tips on how to answer a question on comparison:
  - » Make sure you are comparing the same thing. For example, the population size in the same age range, not different age ranges.
  - » Use comparative words such as larger–smaller, more–less, rapid–slow, and increasing–decreasing.
  - » Only one mark is allocated per comparison, so you need to mention the two different things you are comparing. For example, "The growth is rapid in X but slower in Y", *not* "The growth is rapid in X". If only one thing is named without a comparative word, no mark will be allocated.
- Discuss which stages of the demographic transition model the two countries are in (Japan is in Stage 5 and Namibia is entering Stage 3).
- Use this opportunity to bring in the cross-curricular issue of HIV and AIDs and its effect on life expectancy in Namibia.

- Learners complete Activities 7 and 8 on their own. However, learners with visual impairments will need to work with a sighted learner who can describe the graphs to them.

Homework

Activities 7 and 8 can be finished at home, if necessary.

Suggested answers

Activity 7 **(LB page 186)**

1. Base: Becoming narrower towards the bottom, equal male and female
Middle: Broader than the base, with a peak in the 40–45 years male and female groups
Top: Initially broad, with a peak at 70–74 years, followed by a gradual decrease towards the top. There are more females than males above 65 years.

2. This pyramid suggests an ageing population with a below-replacement level fertility:
Base: Small due to a low fertility rate.
Middle: Increasing due to low death rate and because birth rates were higher in previous generations. The stable shape is due to good healthcare facilities and programs. The peak at 40–45 years is related to the peak at 65–74 years, which was a result of a baby boom after WWII (WWII ended in 1945).
Top: High life expectancy because of advances in medical technology; healthy diets.

Activity 8 **(LB page 188)**

1. Learners' answers may vary. Accept any valid comparison that uses data to support it, for example:
- Japan had a relatively large population in 1950, with 80 million people compared to Namibia's 500 000 people.
- Japan's population rapidly increased to almost 130 million by 2010, while Namibia's population increased more gradually, reaching 2 million people in 2010.
- Japan's population peaked in 2010 with 125 million people, whereas Namibia's has yet to peak.
- After 2010, Japan's population begins to decline, but Namibia's population continues to rise.
- It is predicted that by 2050 Japan's population will have decreased to 105 million people, while Namibia's will have increased to about 4 million.

2.

	Japan	Namibia
Population density	344 km²	3.2 km²
Largest city in terms of population	Tokyo	Windhoek
Birth rate	7.3	25.7
Fertility rate	1.43	3.07
Infant mortality rate	1.9	35.1
Death rate	10.2	7.3
Population growth rate	–0.27%	1.86%
Life expectancy	86 years	65.3 years
Type of population (ageing or young)	Ageing	Young
Literacy rate	99%	91.5%
Natural increase	–2.9	18.4

3. Learners' answers may vary. Accept any logical answers, for example:
- Fewer people are employed.
- Fewer taxes are going to the government due to the decrease in the number of workers.
- More funding is needed for social welfare to take care of the older population.
- More retirement villages need to be built.
- Healthcare facilities and staff need to adapt to treating illnesses usually associated with older people, such as Alzheimer's, dementia and vulnerability to colds and the flu.
- A high supply of daily dietary supplements such as calcium and iron supplements are needed.
- Infrastructure needs to be built to accommodate wheelchairs and people with walking aids.

Continuous assessment

Go through the answers to Activities 7 and 8 as a class. Learners can swap books and mark one another's work. You could record their marks for continuous assessment.

Remedial and extension activities

Remedial

Use the two case studies to revise this topic with learners who need support. Encourage the use of comparisons. For example:

1. Give reasons why there are more people in Japan than in Namibia.
2. Why is the fertility rate higher in Namibia than in Japan?
3. Explain why life expectancy is lower in Namibia than in Japan.

Suggested answers

1. Japan began to industrialise very early, in the 1800s, and, as a result, experienced an early decline in the mortality rate. As with all countries passing through Stages 2 and 3 of the demographic transition model, this led to a rapid increase in population. The country's population then continued to grow off a large base as it transitioned into Stage 4. Japan is also a country with good agricultural resources and water supplies, as well as a historically strong economy, which has allowed it to support high population levels. Namibia is a country with very limited resources, including limited water reserves, which means that it has a very low carrying capacity and has historically supported a limited population. Even as Namibia passes through Stages 2 and 3, and the population growth rate increases, it is growing off a very small base.
2. Japan is in Stage 5 of the demographic transition model and has a declining population, whereas Namibia is still in Stage 2, which is characterised by a high birth rate and rapidly declining death rate. Japan has an elderly, highly educated population, and a high cost of living, whereas Namibia has a youthful population, lower education levels and a rural population. This means there are many young, fertile people in the population who are starting to have children at a young age. Fewer women have the opportunity to attend university or enter the workforce and are instead marrying and having children.
3. Japan is an economically developed country with very good health services. People have access to good nutrition, medication and sanitation, and are well educated. In Namibia, fewer people have access to health services, medication and sanitation or good nutrition, and many people do not have access to clean water.

Extension

1. Learners can investigate other countries, in addition to Namibia and Japan. They must use maps and population pyramids to explain each country's population distribution, population density and stage in the demographic transition model. Suggest to them that they compare a country in Stage 1 or 2 with a country in Stage 5.
2. Stimulate learners' interest and encourage debate by asking their opinions on the use of contraceptives or small families compared to larger families.
3. Learners can investigate other factors that influence food distribution.
4. Show learners the population pyramids of different countries. Ask them to make suggestions about the level of development and the stage of the demographic transition model that each country is in. The more the learners engage with population pyramids and link these to the stages in the demographic transition model, the more familiar they will become with these population tools and models.

TOPIC 3.2 Population movements (migration) LB pages 189–201

Beginning these lessons

Prior knowledge: Learners should be familiar with most of the terminology given in the specific objectives for this topic. However, ensure that they are all on the same level by questioning them on the meanings of the relevant terms and correcting them where necessary. Encourage learners to use examples where possible to illustrate the concepts.

This topic looks at migration patterns both within and between countries, as well as the factors that affect these patterns. Population movement is becoming more and more common, making this topic increasingly relevant and important. It also presents challenges that their generation will have to confront and find sustainable solutions to. Try to make this topic relevant to learners by relating it to their and their families' lives. There may be learners in your class whose families have migrated, or there may be learners who plan to study elsewhere after high school, in which case they could soon become migrants themselves.

Make use of lots of different types of media where possible throughout this topic.

Starter activity

Learners complete the activity on their own. The questions are intended to check whether they remember what pull and push factors are. Afterwards, hold a class discussion, so that learners can compare responses.

Use this opportunity to discuss freedom of movement as a human right, bringing in the Education for Human Rights and Democracy cross-curricular issue.

Suggested answers

1. Learners' answers will vary. Accept any four suitable response, for example:
   Better-paying jobs, more job opportunities, better standards of living, better education and healthcare, better access to services and entertainment.
2. Learners' answers will vary. Accept any four suitable response, for example:
   Poor municipal services such as sewage removal, lack of jobs, low salaries, lack of education and healthcare.

Population migration; Causes of migration

Teaching tips

- Most of the content in this section should be revision. You can use a quiz to check how much learners remember. Use the correct terminology as much as possible while teaching this section. Learners should know these terms by heart and should be able to use them as part of everyday language.
- Learners work in pairs for Activity 1.

Homework

Activity 1 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 1 (LB page 192)

1. Refugees
2. People who are forced to flee from one country to another as a result of war, persecution or violence, are called refugees. People who flee but do not cross an international border are called internally displaced people.
3. **a)** Learners' answers will vary. Accept any three suitable response, for example: Low-paying jobs, sub-standard service provision, high cost of living.
   b) Learners' answers will vary. Accept any three suitable response, for example: Natural disasters, violent conflict, discrimination and oppression of human rights.

Continuous assessment

Walk around the classroom as learners discuss Activity 1. This will give you an indication of which learners require remediation and extension. Go through learners' answers as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Constraints, obstacles and barriers associated with migration; Processes of migration; Patterns of migration

Teaching tips

- Ask learners to share any experiences they have about the different processes and patterns of migration. Discuss whether it was just the young men who moved or the whole family. While discussing the different experiences of male and female migrants, use the opportunity to bring in the Gender Issues cross-curricular issue.
- If learners cannot remember it from previous years, briefly revise settlement hierarchy to help explain the process of step migration.
- Learners work through Activity 2 on their own. They should know by now how to draw the graphs for Question 3, but pay attention to any learners who are struggling and assist them if necessary. Learners with visual impairments may need help drawing graphs as well. Give learners a specific amount of time in which to complete the graphs, such as ten minutes.

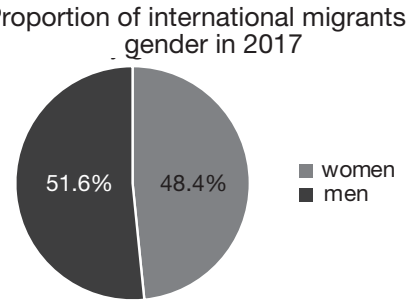
Homework

Activity 2 can be finished at home, if necessary.

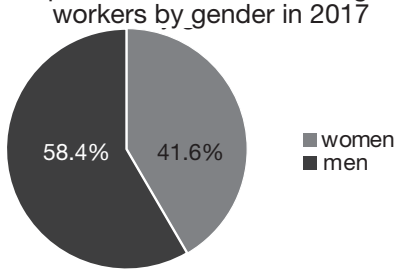
Suggested answers

Activity 2 (LB pages 195–196)

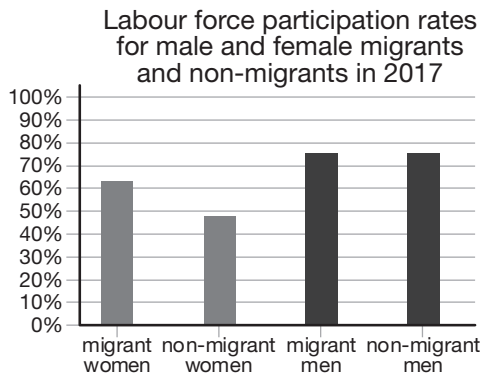
1. Learners' answers may vary. Accept any suitable response, for example:
   Migrants have to obtain specific documents such as passports and visas to live and work in another country. It is also costly to move and set up a new life in a new place. It is likely that people in MEDCs will find these challenges easier to overcome, as their incomes are likely to be higher. The have enough money saved to take time off work to sort out their documents, and to make the move.
2. Step migration is when people migrate up in the settlement hierarchy in stages. Learners' examples may vary. Accept any applicable example and encourage local examples:
   A learner attends school at Okakarara, and then moves to Otjiwarongo for training as a welder. After working in Otjiwarongo, that person applies for a higher-paying job in Walvis Bay. Their application is successful and they move to Walvis Bay to work in a shipyard.
3. **a) i)**



ii)



iii)



b) Historically, migrant labourers have come from low-income countries, as they migrate in search of better work opportunities. In these countries, men are often still viewed as the breadwinner. Furthermore, people from these countries cannot always afford to migrate with their families. In addition, women in more traditional cultures are confined by strict gender roles and are expected to stay at home to take care of the elderly and the children. Therefore, more men than women migrate in search of jobs.

The labour force participation rate is higher for migrant women than for non-migrant women, as women who migrate on their own need to work to support themselves, while migrant families often cannot afford to have just one member of the household working. Furthermore, high-income countries, which receive the bulk of voluntary immigrants, have less conservative gender roles, so it is more acceptable for immigrant women to find work there.

Continuous assessment

Discuss learners' answers to Activity 2 as a class. Learners can swap books and mark one another's work. You could record learners' marks for continuous assessment.

The geographical implications of population change in areas of population loss and gain

Teaching tips

- Discuss the impact of migration on both the migrant as well as the places of origin and arrival.
- Relatively little emigration and immigration occurs in Namibia in comparison to other regions of Africa and the world, so some learners may find the idea of hundreds of thousands of people moving between countries difficult to grasp. Try to find more images and examples from the media to illustrate these concepts.
- Learners take on Activity 3 in groups. For Question 4c, you may need to provide the learners with copies of a written letter, stamped by the school, explaining that they are conducting a survey. Learners must conduct their surveys in groups, and should not engage with strangers outside of safe public places, such as a shopping area. In addition, you should accompany the learners to the public venue where they choose to conduct their survey. Ensure that the location is accessible for learners with physical impairments. If any learners wish to conduct additional surveys on their own, they should only approach family members who they trust.
- Go through the Syrian refugee crisis case study with learners, describing Figure 3.2.13 clearly to learners with visual impairments so they can understand what it shows.
- Learners then complete Question 1 of Activity 4 on their own, and Question 2 in pairs.

Homework

Ideally, learners should complete Activity 3 in class as they are working in groups. They will need to survey people outside of school for Question 4c. Question 1 of Activity 4 can be finished at home, if necessary. Learners should also complete Question 2 of Activity 4 in class as they are working in pairs, but they may need to do additional research outside of class.

Suggested answers

Activity 3 (LB pages 198–199)

1. Migration can have several positive effects on the place of origin. Migrants learn new skills that they bring back to their place of origin. Families that remain in the place of origin receive remittance from migrants. Migrants return home financially independent, if they have managed to save sufficient amounts of money. Unemployment is reduced in the place of origin. The birth rate may decrease. However, there are negative effects too. Male family members often migrate in order to earn an income to support their families, which leads to long periods of disrupted family life and young children having to grow up without their fathers. Mostly young males are sent to find work in order to support their families, which results in a loss of young male workers. When educated and skilled people migrate to other countries, their country of origin loses educated and skilled workers. Labour shortages may arise in some areas of employment. Rural–urban migration leads to a decline in the rural population – especially of working age people. This causes services and businesses to close down, further decreasing the number of jobs available and pushing more people to move away in search of work, resulting in a continuing cycle of outmigration.

2. **a)** Negative, as there are not enough jobs for unskilled workers in the urban areas. Migrants end up living in informal settlements where the quality of life is very poor. Urban areas do not have the resources to provide services to a rapidly growing population and so service delivery deteriorates. Crime rates rise, as people have no other means of survival.
   b) Negative, as young people move away, there are fewer people to tend the land or keep businesses and services open. The rural areas therefore become poorer, and agricultural productivity falls. Fewer inhabitants also means that less government money is invested in the rural areas and less development occurs, resulting in a cycle of decline and outmigration. At the same time, the large influx of people into urban areas means that emigrants struggle to find jobs. This means they are unable to make any money to send back to family in the rural areas, leading to growing poverty in rural areas.
3. Learners' answers may vary. Accept any two effects listed below or other suitable answer:
   - Labour shortages are solved.
   - Migrant workers are usually willing to work jobs that locals find undesirable.
   - Migrant workers are usually willing to work jobs that require long hours.
   - The area is introduced to new cultures, including new foods, music and leisure activities.
4. Learners' answers will vary. Use these questions to revise research competencies such as constructing questionnaires, obtaining information and presenting data.

Activity 4 **(LB page 201)**

1. **a)** Learners' answers may vary. Accept any three factors listed below or other suitable answer:
   Loss of jobs, disruptions to food supplies result in a lack of food, services such as healthcare and education collapse, people cannot get access to medication, homes are destroyed, there is a lack of sanitation and clean water, human rights are abused, family members are killed.
   b) People in the destination country might have to face a sudden huge influx of people. This can strain water and food resources, hospitals and healthcare services, and schools. There may be a lack of jobs because the refugees will work for less pay and the job market may become saturated. Crime rates may rise, if there are too few resources for everyone. Cultural differences can lead to conflict or to a lack of social integration.
   c) Refugees can face a multitude of problems. There may be shortages of water and food resources, hospitals and healthcare provision, schools and housing. They may have to live in refugee camps. Refugees may not have money or belongings. Language barriers make it very difficult to find work and accommodation or to perform tasks like obtaining a bank account. Language and cultural differences can lead to conflict, discrimination and xenophobia. Skilled refugees might end up doing low-income jobs that they are overqualified for due to a language barrier, a lack of available jobs in their field, a lack of experience relevant to the country of refuge or discrimination.
2. Learners need to make their own case study and present it to the class. They should include a variety of multimedia, if possible. Ensure that their information is correct and well researched.

Continuous assessment

Walk around the classroom as learners discuss Activity 3. This will give you an indication of which learners require remediation and extension. Go through learners' answers to both activities as a class and encourage learners to debate the answers. Learners can mark their own work. Make sure that learners' Activity 4 presentations are clear and easy to understand. You could record their marks for continuous assessment.

Remedial and extension activities

Remedial

Ensure that the learners are very familiar with the different key words in the Learner's Book, as it is essential they know the terminology relating to migration. The impacts of movement on areas of emigration, as well as areas of immigration, should

be part of their vocabulary. You can test this in the form of a quiz for learner still struggling with the terminology. If possible, give a small prize to the winner(s).

Extension

1. Learners can look at many different studies to broaden their knowledge on the history of immigration in Namibia as well as elsewhere in the world. For example, they can investigate the different ways in which people migrated to Namibia in the 1600s and 1700s, and the reasons why they did so. This activity is intended to broaden the learners' knowledge, as well as prepare them for further studies, in which research and self-guided learning are expected. Revise with the learners how to do research and help them if they struggle.
2. Learners can discuss the following scenario: *Approximately 20 000 people flee to your area within a week due to a nearby natural disaster*. Learners must think of the different services and resources that might be put under pressure, for example, hospitals, housing, schools, water and electricity, and so on. Ask the learners for ideas on how they think the local government should handle this influx of people.
3. Ask learners to discuss creative solutions to the problem of rural–urban migration. They should consider solutions relating to both the rural areas (for example, strategies that would make it possible/attractive for people to remain in rural areas) and to the urban areas (for example, strategies to handle the influx of rural immigrants).

TOPIC 3.3 Settlement studies

LB pages 202–227

Beginning these lessons

Prior knowledge: In Grades 10 and 11, learners learnt about different types of settlements and settlement patterns (rural/urban/dispersed/nucleated), as well as the factors that influence the size, growth and function of rural and urban settlements, and the problems related to urbanisation.

This topic also looks at the factors that influence the size, growth and function of rural and urban settlements, but focuses on the causes and effects of urbanisation in both MEDCs and LEDCs.

Learners interested in becoming engineers or town planners, or in working in local government, will find this topic particularly interesting.

Discuss career opportunities related to this topic with learners and encourage them to see the relevance of the topic to their own lives.

Starter activity

This activity revises work done in previous years. Learners complete the activity on their own. However, learners with visual impairments will need to work with a sighted learner who can describe the images in Figure 3.3.1 to them.

Suggested answers

Learners' answers may vary. Accept any sensible ideas, for example:

	Type of settlement	Industrial sector(s)	Population size	Possible services
Settlement A	Rural	Primary	1 family	None
Settlement B	Rural	Primary/ Tertiary	Small Few families	A shop, clinic, primary school, service station
Settlement C	Urban	Secondary/ Tertiary	Large	Shops, hospitals, schools, industries, transport, religious, municipal, financial, research, etc.

Factors that influence the size, development and functions of rural and urban settlements and their sphere of influence

Teaching tips

- Use local examples as much as possible to help learners grasp and retain the concepts. You need to help them apply the theory to the world they live in and their own experiences.
- Look into a few familiar Namibia settlements such as Otjiwarongo, Outjo, Lüderitz and Rosh Pinah. Discuss the reasons why people initially settled in each place, factors that affected the growth of each settlement, and the sphere of influence of each settlement.
- Learners work through Activity 1 on their own. However, learners with visual impairments will need to work with a sighted learner who can describe Figure 3.3.6 to them.

Homework

Activity 1 can be finished at home, if necessary.

Suggested answers

Activity 1 **(LB page 205)**

1. a) Learners' answers will vary depending on the area in which they live. For example: Mining resources in Rosh Pinah, or fishing in Walvis Bay.

b) Learners' answers will vary depending on the area in which they live. For example: Rosh Pinah was established due to mining resources, but it grew as miners' families moved to the town and schools, clinics, shops and other services needed to be built.

c) Learners' answers will vary depending on the area in which they live. For example: Windhoek has a large sphere of influence, as it offers services that cannot be obtained in many surrounding towns.

2. a) Town B. It will be close to the husband's work, close to a primary school and within Town C's sphere of influence, where there is a shopping centre.

b) Town C. She could work at the secondary school, and will be close to the shopping centre and cinema.

c) Town C. It offers more services than the other towns, and these services are of a higher order. People will be drawn to the area by the shopping centre and cinema. Older children will travel to go to secondary school.

Continuous assessment

Go through the answers to Activity 1 as a class. Learners can swap books and mark one another's work. If learners choose different towns for Question 2, encourage them to explain their reasoning and discuss whether it is the best choice. You could record their marks for continuous assessment.

Factors that lead to rural depopulation; Possible solutions to rural depopulation; Urbanisation in low-income countries compared with high-income countries

Teaching tips

- Rural depopulation is very real in Namibia. Urban areas have grown rapidly since independence. At the same time, infrastructure in rural areas is deteriorating as more and more people leave. Many of your learners may have noticed this and will be familiar with many of the factors that lead to rural population and rapid urbanisation, so encourage them to relate their existing knowledge in a class discussion.
- Describe Figures 3.3.7 and 3.3.9 clearly to help learners with visual impairments understand what they show.
- Learners complete Question 1 of Activity 2 on their own, and work in pairs for Question 2. Ensure that any learners with visual impairments work with a sighted learner who can describe Figure 3.3.11 to them.

Homework

Question 1 of Activity 2 can be finished at home, if necessary. Ideally, learners should complete Question 2 in class, as they are working in pairs.

Suggested answers

Activity 2 **(LB page 211)**

1. a) Unemployment in the rural area.

b) Learners' answers may vary. Accept any two of the following or other reasonable answers: Lack of available farm land, land degradation, disasters such as droughts and floods, for further education, for better-quality services such as healthcare, for lifestyle reasons and to escape gender discrimination.

c) Learners' answers will vary, depending on their answer to Question 1b. Accept any reasonable answer, for example:

- Developing educational institutions in the rural areas, thereby allowing people to remain there and still pursue higher education
- Promoting conservation farming methods in rural areas and methods to improve agricultural productivity
- Promoting decentralisation and the development of smaller urban centres to service rural areas
- Providing support to subsistence farmers and improving services in rural areas, such as access to potable water and electricity.

2. a) South-East Asia, North-East Asia, the Indian subcontinent, West Asia, Central West Africa, North and Central East Africa

b) Low-income countries

c) High birth rates and low death rates lead to a fast-growing population. Much of the

stimulus for urbanisation in low-income countries has been the result of push factors such as drought, land degradation and shortage of agricultural land for subsistence farmers.

d) Learners' answers may vary. Accept any three of the following or other reasonable answers:
- Limited economic growth: Many low-income countries are urbanising without industrialising or expanding their manufacturing sectors. This means that wages remain low and there are limited funds available to develop essential services and infrastructure.
- Lack of employment opportunities: The rate of job creation cannot keep up with the large influx of migrants.
- Overcrowding and development of informal settlements: Without money or a steady income, people quickly find themselves living in informal settlements, slums or on the street, often in overcrowded conditions.
- Pressure on services and infrastructure: The combined effect of low economic growth and rapid urbanisation means that services and infrastructure in low-income countries are placed under heavy strain. For example, electricity cannot be supplied to all residents or there are periodic disruptions in power supply. Instead of raising productivity in urban areas, poor infrastructure and service provision acts as a barrier to productivity and economic growth.
- High crime rates: In low-income countries especially, people struggling to survive turn to crime for a source of income.
- Low standards of living: With poor infrastructure, services and housing, as well as limited employment opportunities and high costs of living, come low standards of living.

Continuous assessment

Go through the answers to Activity 2 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Reasons for the changing size and distribution of cities around the world; Problems related to urbanisation

Teaching tips

- Learners usually find the growth of megacities fascinating. Show them images and videos on the changes within these cities over the last few decades. Describe these changes as well as the information shown in Figures 3.3.12 and 3.3.13 clearly to help learners with visual impairments understand what they show.
- Also make use of images to illustrate urban problems such as traffic jams, especially in megacities, where peak traffic hours see hundreds of thousands of cars on the roads.
- Point out to learners that they have probably noticed the growth of informal settlements and the increasing need for improved transport infrastructure.
- Learners complete Question 1 of Activity 3 on their own, and work in pairs for Question 2. However, any learners with visual impairments may need to work with a sighted learner who can assist them.

Homework

Question 1 of Activity 3 can be finished at home, if necessary. Ideally, learners should complete Question 2 in class, as they are working in pairs.

Suggested answers

Activity 3 **(LB page 216)**

1. a) Mainly in Europe and eastern North America, as well as Tokyo in Japan and St. Petersburg in Russia

b) Most are in East and South Asia; specifically China, India, Bangladesh (Dhaka), and Japan; Mexico City is in North America, and São Paulo is in South America. There is also one in North Africa (Cairo).
- Economic growth: The change in the growth and distribution of the world's largest cities from Europe and Northern America to Asia and South America is related directly to the emerging economic status of these regions. All are newly industrialised

countries. The size of cities appears to be linked directly to economic status.
- Population growth: Some NICs with rapidly developing economies also have very large and rapidly growing populations. As a result, their cities outpace the growth of cities in some of the older highly developed countries. In addition, some of the world's largest cities owe their size to being capital cities in populous nations, rather than to their economic status or their role within global production.
- Rural–urban migration: Rural–urban migration is linked to the number of opportunities offered in cities. For this reason, rural–urban migration is highest in NICs with large rural populations. Poor service provision in rural areas, lack of jobs, increasing rural populations and natural disasters are other factors pushing people to urban areas.

2. Learners' answers may vary. Accept any two of the following or other reasonable answers:
   - Traffic increases as more people need to travel into the city centre.
   - Agricultural land is lost.
   - The cost of providing services increases.
   - Infrastructure needed by people (such as roads and power lines) replaces the natural vegetation.
   - Animal habitats are lost.

Continuous assessment

Discuss learners' answers to Activity 3 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Solutions to urban problems

Teaching tips

- Urban planners need to be informed about new developments and the latest technology in power, water, sanitation and transport provision to prevent and mitigate urban problems. Use this opportunity to bring in the Road Safety cross-curricular issue and its importance in urban planning.
- Describe Figure 3.3.18 clearly to help learners with visual impairments understand what it shows.
- Learners complete Question 1 of Activity 4 in pairs. Question 2 can be discussed in groups or as a class. Learners might have alternative ideas to those found in the case study. Debate how feasible these are.
- Make sure that learners assist group members with hearing impairments. They should be careful to talk in turn and maintain eye contact.

Homework

Activity 4 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs and groups.

Suggested answers

Activity 4 **(LB page 221)**

1. Singapore has a growing population, high population density, and limited space for expansion of transport infrastructure. It is also an affluent city and many people can afford private vehicles, putting pressure on road infrastructure.
2. Learners' answers may vary. Accept any reasonable answers, for example: Singapore's extensive public transport network is the most successful solution to its transport issues, as nearly 60% of commuters in Singapore make use of public transport. It is available throughout the city and gives people access to work, shopping and recreation all without needing a car.

Continuous assessment

Walk around the classroom as learners discuss Activity 4. This will give you an indication of which learners require remediation and extension. Discuss learners' answers as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Causes and effects of change within urban areas

Teaching tips

- Revise the different urban settlement models that were covered in Grades 10 and 11. Discuss the advantages and disadvantages of each model. Learners should know which model is most applicable to their town or city, and whether this has changed over the years.

- Describe Figures 3.3.22, 3.3.23 and 3.3.24 clearly to help learners with visual impairments understand what they show.
- Also discuss any changes in the economic activities of their town and other well-known urban areas of Namibia. For example, Windhoek started to develop because it was the most central place in Namibia, and it is now the political and economic capital of Namibia. Most of the larger towns in Namibia have changed a lot in the last 20 years. Learners can make observations on this and look into decentralisation (Windhoek), gentrification (Swakopmund), development of business parks and industrial parks (Walvis Bay), development of shopping centres outside CBD areas (Okahandja), low-cost housing projects (most urban areas), and so on. Town maps are widely available for free on the Internet. Use newspaper articles and the learners' knowledge to indicate changes on these maps.
- Learners complete Questions 1 and 2 of Activity 5 on their own, and work in groups for Question 3. However, ensure that any learners with visual impairments work in pairs with a sighted learner who can describe Figure 3.3.24 to them.

Homework

Questions 1 and 2 of Activity 5 can be finished at home, if necessary. Ideally, learners should complete Question 3 in class, as they are working in groups.

Suggested answers

Activity 5 **(LB page 224)**

1. Increasing horizontal growth and declining density; cities are becoming multi-nodal; economic activities have changed, especially in MEDCs
2. Faster and safer transport options allow people to live further away from work and commute every day. Improvements in transport have also allowed for goods to be moved around more efficiently, thus reducing the need for industrial centralisation.
3. **a)** It has a multi-nodal urban form, as there are at least two main areas: the modern area and the older part of the city.
   b) No, the older part of the city likely had a more nucleated pattern, as most older cities did.
   c) i) Riga's economy may have changed from one based on secondary activities to one based on tertiary activities, such as services related to tourism.
   ii) The government has made an effort to preserve the older part of town, building modern developments away from this area. Most of the older part is only for pedestrian use, allowing tourists to safely walk around and enjoy the area. The move away from manufacturing has facilitated this, as it has allowed for gentrification of the older city. In addition, tertiary activities are easier to relocate than manufacturing facilities.

Continuous assessment

Walk around the classroom as learners discuss Question 3 of Activity 4. This will give you an indication of which learners require remediation and extension. Discuss learners' answers as a class. Learners can swap books and mark one another's work. You could record their marks for continuous assessment.

The inequalities in living standards that may arise in cities

Teaching tips

- Images of different types of neighbourhoods are freely available on social media. Make use of these in your lessons to spark awareness of inequalities in urban areas. Ask learners how they would solve these issues.
- A trip to the nearest informal settlement might help learners understand the challenges that inhabitants face. Alternatively, there may be learners in your class who stay in an informal settlement. Encourage them to share their experiences with the class, but be sensitive to any embarrassment they may feel about their living situation, especially if few other learners live in a similar situation.
- Learners work through Activity 6 in pairs.

Homework

Activity 6 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 6 **(LB page 226)**

1. a) Learners' answers may vary. Accept any ten of the following:
- John needs to work more than one job to survive.
- His house was built from any available material.
- There is very little furniture in his house and there is no space for a proper bed and kitchen.
- He has no water in the house; it has to be fetched from a distance using a bucket.
- There is no electricity in the house. John has to cook on a gas stove.
- Wood is very expensive in Swakopmund, as it needs to be brought from inland, so making a fire is a luxury.
- When the wind is blowing, fires can become a hazard and can quickly spread to other shacks, which burn easily.
- He only has a pit toilet, which has to be shared.
- Strong winds often blow shacks away.
- The shacks get full of sand when there is a sandstorm.
- People get ill easily due to wet conditions.
- His wife and child do not live with him; they have to stay in the single quarters, as she does not have a job.
- He has to support his immediate family in the city and his extended family in the rural area.
- Crime is a problem. John's bicycle was stolen, and so is any food he tries to grow.
- The waiting list for low-income housing is very long.

2. The cycle of poverty starts with a person who has little education and few skills. As a result, they can only find a low-paying job. They struggle to pay for their basic needs such as housing and food. Their children need to work to help provide for the family, which means they too leave school early and receive little education. With each generation, the circle repeats. Informal settlements lack basic services, including sanitation and healthcare, and are sometimes far away from potential jobs. All of these factors lead to poor health, further decreasing people's ability to work and study.

3. Learners' answers may vary. Accept any of the following or other reasonable answer:
- Running water at home will be most helpful, as it can be used for cleaning, improving inhabitants' overall health.
- Electricity will be most helpful, as it will reduce pollution from firewood, save lives by preventing the spread of fires, and allow people to study at night or do other chores requiring electricity.

4. Insufficient sewerage infrastructure in the informal settlement can result in polluted water seeping into the groundwater supply, causing a deterioration in the quality of water sources in the area. During the rainy season, litter from the informal settlement can also end up in the dams and lakes that supply the city with water, further decreasing the quality of the water.

Continuous assessment

Go through the answers to Activity 6 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Features of urban change in high-income countries

Teaching tips

- If possible, find before and after images of areas that have been gentrified in your nearest urban area to illustrate this concept for learner. Alternatively, learners who have experienced gentrification of their own neighbourhood or nearby neighbourhoods could share their stories.
- Divide the class into groups of five to seven learners for Activity 7. Ensure that the whole group is involved by delegating specific tasks to each group member. This activity should be done over two to three lessons. Study a map of your town and the relevant areas with the learners before they record their data.

You may need to help groups who are having trouble understanding how to use a pictogram. Ensure that learners with visual or hearing impairments are assisted as needed by the other group members. If groups are all studying a different area of town, you could combine all their data into one overall pictogram as well.

Homework

Learners will need to record their data for Question 1 of Activity 7 outside of class.

Suggested answers

Activity 7 **(LB page 227)**

1. Learners' answers will differ, depending on the area studied. Ensure that learners' data is correct and that their pictograms show the recorded data accurately.
2. Learners' answers may vary. Accept any three of the following or other suitable response:
   - Low property prices in rural areas
   - Fresh air in rural areas
   - Less noise in rural areas
   - Better climate in rural areas
   - More space for children to play in rural areas
   - Rise of urban decay in inner-city areas
   - Ease of commuting or working from home due to modern infrastructure.

Continuous assessment

Walk around the classroom as learners work in their groups. This will give you an indication of which learners require remediation and extension, and help you ensure that all learners are contributing. Make sure that learners' presentations are clear and easy to understand. Discuss learners' answers to Question 2 in class. Learners' can mark their own work. You could record their marks for continuous assessment.

Remedial and extension activities

Remedial

Ask learners to write down definitions for the following terms, without referring to their Learner's Books:

- Sphere of influence
- Threshold population
- Urbanisation
- Megacity
- Rural–urban migration
- Urban sprawl
- Urban decay
- Urban planning
- Satellite settlements
- Site-and-service schemes
- Urban settlement model
- Informal settlement
- Counter urbanisation
- Gentrification.

Suggested answers

Definitions can be found in the key word boxes in the Learner's Book or can be inferred from the body of the topic. Check the learners' answers to assess whether they have understood these key concepts relating to this topic, and provide extra support to those who struggle to define the terms.

- Sphere of influence: the area that depends on the goods and services provided by an urban settlement
- Threshold population: the smallest number of people needed in an area to support a service or function
- Urbanisation: the shift or movement of people from rural areas to urban areas (towns and cities), leading to the increasing proportion of people living in urban areas
- Megacity: a city with a population of over 10 million people
- Rural–urban migration: the migration of people from rural to urban areas
- Urban sprawl: the outward spread of cities into the surrounding rural area
- Urban decay: when a previously functional city or part of a city falls into disrepair and begins to deteriorate
- Urban planning: the job or process of directing and managing land use in cities and town through planning, administration and legislation
- Satellite settlements: planned settlements built near to major towns or cities that are designed to be self-sufficient and serve as places of work, residence and leisure
- Site-and-service schemes: these are schemes to provide low-income communities with access to plots of land that are serviced with water, sewerage, roads and electricity. People buy the land and build their own house on the land

- Urban settlement model: schematic diagrams of how urban areas are laid out. These show how different land-use zones are distributed in relation to one another in typical urban settlements
- Informal settlement: unplanned settlement of informal dwellings constructed on land that does not have essential services and is not owned by the people living there
- Counter urbanisation: the movement of people from urban to rural areas
- Gentrification: process where a run-down neighbourhood is upgraded by improving existing buildings and attracting new businesses and residents to the area

Extension

Learner can read about Wilko Mohr, a Namibian student at Stellenbosch University, who designed a computerised control system to help improve traffic flow in Stellenbosch, a university town in the Western Cape, South Africa. The project was part of his master's degree in engineering. More information can be found by searching for "Wilko Mohr" online. Use this example to inspire your learners and to show that Namibians can contribute successfully to solving global challenges. Namibian learners do really well if they are motivated in further studies both locally and abroad. Namibian learners are known to be good researchers and those who are able to study at international universities often excel. Use this activity to show your learners that hard work and dedication will take them beyond what they thought possible. Encourage them to give their best, as doors will open for those who are dedicated.

Self-assessment (LB pages 230–231)

Topic 3.1 Population studies

1. a) Areas with a high population density include South Asia, East Asia and South East Asia (specifically India, Pakistan, Sri Lanka, Bangladesh, China, South Korea, and Indonesia). Other areas include Western Europe (with a very high concentration of people in the United Kingdom, and parts of Eastern Europe), the east coast of North America, and to a lesser extent the central east coast of South America. The Nile River Valley has a very high population density, as do parts of central West Africa, eastern Africa and South Africa. Areas with a low population density include Russia, Mongolia, Kazakhstan, Canada, Greenland, Saharan Africa, west and central Australia and central Brazil. Places with moderate temperatures and adequate rainfall that are close to rivers and the ocean tend to be more densely populated. Areas with extreme temperatures, little rainfall, high altitudes and high latitudes tend to be sparsely populated. (8)

b) The Nile Valley is densely populated, because the Nile is a permanent river and deposits fertile silt from central Africa on its floodplain. Desert areas such as the Sahara, Namib and Kalahari have a low population density. In central West Africa, along the Niger River and other permanent rivers, population density is high. Around the great lakes in central Africa, the population density is high. (4)

2. An area is overpopulated when there are more people than its natural resources can sustain. An area is underpopulated when the people in an area are too few to fully exploit the available resources. Optimum population is reached when the people living in the area and the natural resources are well balanced. (3)

3. Many farmers in LEDCs eat too little, both in quantity and variety of food, and suffer from malnutrition. Farmers are caught in a cycle of poverty where they are not strong enough to work, so yields are low and there is little surplus for sale or to reinvest in farming. This cycle of poverty makes it difficult to improve food supplies. (4)

4. a) Learners' answers will vary. Accept any three of the following or other logical answer:
- Provide incentives to have more children, such as free day care and lower taxes.
- Make sure returning to work after having a baby is easier for women.

- Ensure that loans for tertiary education are interest free to make it cheaper for parents to send their children to colleges or universities.
- Encourage the immigration of young people to the country.
- Change the retirement age to 70 years, to prevent a large, dependent, old population (3)

b) Learners' answers will vary. Accept any three of the following or other logical answer:
- Run awareness campaigns on the use of contraceptives and family planning.
- Distribute free condoms.
- Improve family planning education in school, and encourage women to pursue careers and delay starting a family.
- Help women to find work or start businesses.
- Provide information on better diets.
- Stress the importance of drinking clean water, and show people how to clean water.
- Provide healthcare facilities such as clinics and hospitals in the rural areas.
- Visit schools to vaccinate learners, preventing diseases such as polio and measles.
- Broadcast information on the radio and television about the dangers of HIV and AIDS.
- Run AIDS awareness campaigns.
- Provide free education.
- Inform women (especially teenagers) about their rights.
- Educate pregnant women about healthy diets for babies and themselves. (3) **[25]**

Topic 3.2 Population movements (migration)

5. a) Approximately 2 million people are moving internally inside South America. More people are emigrating than immigrating, resulting in a migratory deficit of between 1 million and 5 million people. Emigration is mainly to North America and Western Europe, while immigration is largely from Western Europe. (5)

b) North America, as people immigrate to the area from South America, Meso America, the Caribbean, Australia and New Zealand, South East Asia, North West Pacific and East Asia, Western Europe, Central Europe, and South Asia. The migratory surplus is between 12 and 37 million people. Internal (intra-zone) migration is relatively low at 2 million people. (4)

c) Internal or intra-zone migration (1)

d) North America and Western Europe (2)

e) i) Central Europe, South Asia and Meso America (3)

ii) Both. People migrate from Central Europe to Western Europe and North America in search of better work opportunities and higher salaries (voluntary). People migrate from South Asia in search of better work opportunities (voluntary) but also to escape poverty or persecution (involuntary). People leave Meso America in search of better work opportunities (voluntary), but also to flee from political instability and violence. (6)

iii) Learners' answers will vary. Accept any three of the following or other logical answer: Lack of documentation, lack of qualifications, difficulty finding housing, difficulty finding a job, language and cultural barriers, travel dangers, xenophobia, closed borders (3)

f) South Asia has the most intra-zone movement, with 14 million people moving within this region. Southern Africa has far fewer intra-zone migrants at 2 million. Australia and New Zealand have less than 2 million intra-zone migrants. (3)

6. Learners' answers will vary. Accept any logical answer, for example:
Migrants are often of young and fertile, which can result in population growth. Large-scale migration due to war and political instability in the place of origin can result in a need for refugee camps. Food, medicine and other services therefore need to be provided. There might be a shortage of food or medicine and the

need for aid. Provision of clean drinking water could potentially be a problem if the country of arrival is a desert area. Lack of sanitation could be a health risk, and result in a polluted water supply. Tension may develop when locals and migrants have to compete for resources such as land, basic services like housing, and employment opportunities, which can lead to xenophobia or genocide. (5)

7. Learners' answers will vary. Accept any logical answer, for example:
Yes, chain migration, where one person migrates, and then friends, siblings and parents eventually follow, often occurs. Family and friends provide support to one another, for example, by offering advice, sharing costs, supplying information about work opportunities, and providing temporary accommodation or a permanent place for their family to live. Eventually, a lot of related migrants settle in a specific area. (4) **[36]**

Topic 3.3 Settlement studies

8. a) A demographic and social process whereby people move from urban to rural areas. (1)

b) The process whereby an existing neighbourhood is changed by upgrading existing buildings and bringing in businesses. (1)

9. a) The central business district (CBD) (1)

b) Central Park is a recreational area for people living and working in Manhattan. It also serves as a green belt, absorbing carbon dioxide and producing oxygen, and reducing noise pollution. It also reduces the urban heat island effect, and reduces flood risk by providing vegetation and an area with fewer artificial surfaces. (3)

c) Learners' answers will vary. Accept any of the following or other logical answer:
- Traffic congestion, which can be improved through increasing public transport options
- Power shortages, which can be improved by installing solar energy panels
- Low water supply, which can be improved making use of grey water. (2)

d) Unless they are travelling via underground rail, people travelling to Manhattan need to cross a bridge to enter the city, which bottlenecks the roads and may lead to traffic congestion. (2)

e) Learners' answers will vary. Accept any logical solutions, for example:
Encourage more people to use the underground rail; add more stops to the underground rail; encourage more people to use buses rather than private vehicles; charge people to use the bridges, especially during peak hours. (2)

10. a) Learners' answers will vary. Accept any three of the following or other suitable answer:
- Industrialisation concentrates job opportunities into small urban areas and raises the standard of living in the area. People move to these areas for a chance at a better life.
- The high birth rate in rural areas, along with decreasing death and infant mortality rates, means there is too little land to produce enough food for the growing family, and not every child is able to inherit.
- Severe droughts and floods, as well as soil erosion caused by overgrazing, drastically affect agricultural production. Climate change accelerates these problems. This pushes people to move to urban areas in search of work.
- Advances in farm equipment and machinery decrease the amount of labour needed, so unemployment increases in rural areas.
- Rural depopulation has a cyclical effect. It is usually young men who move to the city first, leaving women, children and the elderly to work the farms, decreasing food production. Fewer people in the area causes businesses and services to close, including schools and clinics. Urban areas become the only place where people can obtain healthcare and children can receive an education. Decreasing food supplies and lack of services cause more people to move to urban areas, further depopulating the region.

- Nomadic groups cannot cross borders freely in search of water and grazing land. They are forced to change their way of life. Fewer young people are able to live the life of their parents and instead move to urban areas.
- People living in rural areas are attracted to urban areas by the promise of bright lights, jobs and services. (6)

b)
- Timing and rate of urbanisation: Urbanisation in high-income countries started much earlier and took place over a much longer time period (a century or two after industrialisation) than urbanisation in low-income countries. The rate of urbanisation in high-income countries has since stabilised. Low-income countries only began to urbanise more recently, towards the end of the 20th century, and their rate of urbanisation has been much faster. Rapid urbanisation in low-income countries is still ongoing.
- Processes in high-income countries: Urbanisation in high-income countries began as a response to the rapid growth of industries following the industrial revolution. This created a large demand for labour, which pulled people from rural to urban areas. Additionally, when urbanisation began in high-income countries, death rates were still high, so the overall population was small and population growth rates were low. This meant that urban growth was able to keep pace with population growth as death rates fell.
- Processes in low-income countries: Urbanisation in low-income countries began after populations started to rise and so urban areas have struggled to keep up with population growth. Urbanisation in these countries has also often occurred without corresponding industrial growth, as low-income countries still have largely agricultural economies. Much of the stimulus for urbanisation in low-income countries has been the result of push such as drought, land degradation and shortage of agricultural land for subsistence farmers. (9)

c) Learners' answers will vary. Accept any two of the following or other suitable answer:
- In high-income countries, there is increased economic growth, while in low-income countries there is limited economic growth.
- In high-income countries, standards of living increase, while in low-income countries there is overcrowding, the development of informal settlements, and pressure on services and infrastructure.
- In both high-income countries and low-income countries, the cost of living increases.
- In both high-income countries and low-income countries, consumption of resources increases. (4)

11. a) People who migrate to urban areas as a result of push factors such as poverty or lack of land in rural areas cannot afford to purchase property, or do not have the skills needed to earn enough money to buy a house in an urban area. As a result they are forced to live in informal settlements. This is especially the case when rural–urban migration occurs rapidly, resulting in a shortage of low-cost housing. High levels of unemployment also result in the development of informal settlements. The informal settlement may also be much closer to work, attracting inhabitants who cannot afford to commute long distances. Even inhabitants who can afford low-cost housing may not be able to pay for the associated costs such as power and sewage removal. (5)

b) Learners' answers will vary. Accept any logical answer, for example: The government needs to build more low-cost housing, which consists of a basic house (kitchen, toilet, walls and roof). They are solid, professionally built structures that provide proper protection from the weather. They also come with running water, a sewerage system and access to electricity. (3) **[39]**

Total: 100 marks

Theme 4 Interpretation of topographic maps

Syllabus coverage	See the year plan in Section B (pp. 11–16)
General objectives	**Topic 4.1: Plate tectonics** Know how to read and interpret various topographic maps
Specific objectives	The specific objectives are listed in the year plan in Section B in this Teacher's Guide and at the beginning of each topic in the Learner's Book.
Cross-curricular issues	• Environmental Learning: Topic 4.1 • Population Education: Topic 4.1 • Information and Communication Technology (ICT): Topic 4.1 • Road Safety: Topic 4.1
Inclusive education	• Learners with visual impairments need assistance with understanding diagrams, maps and photographs. • Learners with hearing impairments need to be accommodated during group work activities and class discussions. Have other learners assist them with visual cues or notes, and make sure all learners maintain eye contact and talk in turn so that everyone can easily follow the discussion. Encourage learners with hearing impairments to sit at the front of the class. • Pair more confident learners with learners who are experiencing difficulty. This will give the learner who needs support the opportunity to benefit from their partner's knowledge, while the confident learner will be able to revise the content, as well as develop the ability to assist others in an appropriate, non-judgemental way.
Suggested teaching time	• Topic 4.1: 40 lessons • Revision and self-assessment: 10 lessons
Additional resources needed	Maps (particularly topographic maps); atlases; ruler; protractor; string; photographs of landscape features, Google Maps and Google Earth (if access to the Internet is available)

Introduction to this theme

This theme focuses on reading and interpreting topographic maps. Spend some time looking at the pull-out map provided in the Learner's Book. Ask learners what type of map it is and what area it shows. Flip through the Learner's Book and point out other types of maps. Help learners to identify the title, key and scale of each map. Remind learners of the map-reading skills they learnt in Grades 10 and 11.

TOPIC 4.1 Interpretation of topographic maps LB pages 234–265

Beginning these lessons

Prior knowledge: Learners will develop and extend the map-reading skills they learnt in previous years.

This topic covers the essential characteristics of a map (title, key, direction and scale), as well as how to interpret maps and identify landforms using symbols and contours. Show learners the standard features of a topographic map, as found on the pull-out map provided in the Learner's Book. Learners find out how to use a map scale. Once learners know how to work with a linear scale, ratio scale and word scale, they can use scale to measure straight- and curved-line distances on maps as well as the area of regular- and irregular-shaped features. Learners learn how to work with compass directions, so that they are able to orient a map, find the direction from one place to another, and navigate using a map. Next, learners locate features on a map using latitude and longitude. Learners then use these skills to analyse and interpret the physical and human landscape by referring to map and photographic evidence.

Starter activity

Last year, learners learnt to recognise the characteristics of a good map. This activity helps them review what they know.

Divide the learners into pairs for this activity. They can do the activity orally first. Ensure that any learners with visual impairments work with a sighted learner who can describe the maps and symbols to them. Discuss the answers with the class before the learners write them down.

Suggested answers

1. **a)** Keetmanshoop
   b) Ratio scale: 1:50 000
   Word scale: 1 unit on the map represents 50 000 units in reality.
   c) **i)** Monument
   ii) Single-track railway
   iii) Main road
   iv) Trig beacon
   v) Grassland
   vi) Swamp
   d) True North and Magnetic North
2. **a)** Population distribution and average population density in Namibia
   b) Ratio scale: 1:9 090 000
   Word scale: 1 centimetre on the map represents 91 kilometres in reality.
   c) **i)** A red square
   ii) A black dot
   iii) A dashed purple line
   iv) A solid purple line
   v) A solid green line
   vi) A solid purple fill

Characteristics of a map

Teaching tips

- List the characteristics of a map on the board and explain each one to the learners.
- Use maps in the Learner's Book and in atlases to point out the characteristics.
- If possible, use a wall map to show learners where all the features are located.
- When you explain the key, point out which of the symbols show water features, communication links, human activities, physical features, human-made features, natural features, altitude, and so on. It is important that learners know what the symbols on the map represent, because these give them important clues about the physical features and human activities in an area.
- Use a variety of maps with different keys to show learners the different things these indicate. Also, show learners that there are different ways in which the scale is indicated.
- Learners then complete Activity 1 on their own. However, learners with visual impairments will need to work with a sighted learner who can describe Figure 4.1.1 in the Learner's Book to them.

Homework

Learners can complete Activity 1 at home, if there is not enough time to complete it in class.

Suggested answers

Activity 1 **(LB page 236)**

1. Tourist map of Namibia
2. 1:10 000 000

3. **a)** Learners' answers will vary. Any three of the following: Hoba Meteorite, Kolmanskop, Fish River Canyon, Spitzkoppe, Cape Cross Seal Reserve, Twyfelfontein, Sossusvlei, Hartman Valley
   b) B1
   c) B6
   d) Other road
   e) Windhoek, Walvis Bay, Tsumeb
   f) Learners' answers will vary. Any two of the following: Namib–Naukluft National Park, Skeleton Coast National Park, Dorob National Park

Continuous assessment

Go through the answers to Activity 1 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Using the scale of a map

Teaching tips

- Revise the concept of a scale. Remind learners that the scale tells us how much larger features on the map are in reality. The scale is used to convert distances on the map to distances in reality.
- Go through the different types of scale. Review the three ways in which scale can be indicated on a map. Ask learners to find the scale of some of the maps in the Learner's Book.
- Carefully explain how to convert from one type of scale to another. Do examples of each type of conversion on the board.
- Explain how to measure straight- and curved-line distances, and how to convert the centimetre measurement into metres or kilometres.
- Learners can then work through Activity 2 on their own. However, learners with visual impairments will need to work with a sighted learner who can assist them.
- Remind learners of the formula to find the area of a regular shape such as a square or rectangle. They have learnt this in their Maths lessons. Do a worked example on the board with the learners. Stress that they must convert to distances in reality before multiplying the length by the breadth.
- Demonstrate how to calculate the area of an irregular shape using the example in the Learner's Book.
- Then, explain how area of composite shapes is measured and calculated.
- Learners complete Activity 3 on their own. However, learners with visual impairments will need to work with a sighted learner who can assist them.
- Give the meaning of *gradient*, *vertical interval* and *horizontal equivalent*. Draw a slope with a steep gradient and a slope with a gentle gradient on the board to help explain these concepts.
- Explain that when we use a map to calculate gradient, we are calculating the ratio between the difference in height between two points in relation to the horizontal distance on the land between these two points. Go through the steps that must be followed to calculate gradient:
  - » Find the difference in height between two points by examining the contour lines.
  - » Measure the distance between the two points.
  - » Convert both measurements to the same unit. Write the measurements as a fraction
  - » Reduce the numerator to 1. Do this by dividing the numerator and denominator by the numerator. Then write the gradient as 1 in something.
- Figure 4.1.11 in the Learner's Book gives examples of slopes with different gradients. Point out that when we calculate gradient on a map, we calculate the average gradient.
- Learners then work through Activity 4 in pairs. Ensure that any learners with visual impairments work with a sighted learner so that the map and information can be described to them.

Homework

Activities 2 and 3 can be finished at home, if necessary. Ideally, learners should complete Activity 4 in class, as they are working in pairs.

Suggested answers

Activity 2 **(LB page 238)**

1. **a)** ±4.6 cm × 0.5 km = ±2.3 km = ±2 300 m
   b) ±17.5 cm × 0.5 km = ±8.75 km
   c) ±15 cm × 0.5 km = ±7.5 km
2. **a)** ±21 cm × 0.5 km = ±10.5 km
   b) ±17.2 cm × 0.5 km = ±8.6 km
3. **a)** ±10.5 km − 8.75 km = ±1.75 km
   b) ±8.6 km − 7.5 km = ±1.1 km

Activity 3 (LB page 241)

1. a) A = B × H
B = 6 cm × 500 m = 3 000 m
H = 3 cm × 500 m = 1 500 m
A = 3 000 m × 1 500 m = 4 500 000 m^2

b) A = ½ (B × H)
B = 6 cm × 0.5 = 3 km
H = 4 cm × 0.5 = 2 km
A = ½ (3 km × 2 km)
= ½ (6 km^2)
= 3 km^2

c) Area of rectangle:
A = B × H
B = 7 cm × 0.5 km = 3.5 km
H = 4 cm × 0.5 km = 2 km
A = 3.5 km × 2 km = 7 km^2
Area of triangle:
B = 4 cm × 0.5 = 2 km
H = 3 cm × 0.5 = 1.5 km
A = ½ (2 km × 1.5 km)
= ½ (3 km^2)
= 1.5 km^2
Area of composite shape:
7 km^2 + 1.5 km^2 = 8.5 km^2

2. a) Rectangle
A = B × H
B = 50 cm × 0.5 km = 25 km
H = 50 cm × 0.5 km = 25 km
A = 25 km × 25 km = 625 km^2

b) Parallelogram
A = B × H
B = ±5 cm × 0.5 km = ±2.5 km
H = ±3 cm × 0.5 km = ±1.5 km
A = ±2.5 km × ±1.5 km = 3.75 km^2

c) Learners will trace the outline shape of the built-up area. They then use a grid of 1 cm squares, as illustrated in Figure 4.1.9 in the Learner's Book.
Learners' answers may vary slightly. The following is a guide:
Number of whole squares: 28
Number of partial squares: 23
23 ÷ 2 = 11.5 squares
28 + 11.5 = 39.5 squares
Each square is 0.25 km^2 (0.5 × 0.5 = 0.25)
39.5 × 0.25 = 9.875 km^2

Activity 4 (LB page 243)

1. a) VI = 1 066 − 992
= 74 m
HD = ±5.5 cm × 500 m
= ±2 750 m
$G = \frac{VI}{HD}$
$= \frac{74}{\pm 2\,750}$
$= \pm\frac{1}{37.16}$ or 1:37.16

b) VI = 1 032 − 960
= 72 m
HD = ±1.8 cm × 500 m
= ±900 m
$G = \frac{VI}{HD}$
$= \frac{72}{\pm 900}$
$= \pm\frac{1}{12.5}$ or 1:12.5

2. a) VI = 1 027 − 982
= 45 m
HD = ±20.5 cm × 500 m
= ±10 250 m
$G = \frac{VI}{HD}$
$= \frac{45}{\pm 10\,250}$
$= \pm\frac{1}{227.78}$ or 1:227.78

b) Non-perennial

c) The river flows slowly. It has a very gentle gradient.

d) The river flowing is flowing downhill from S to T. So, it flows in a south-easterly direction.

Continuous assessment

Ask learners questions to assess whether they have understood the content. While the learners are working on the activities, walk around the class and check that they are able to do the calculations correctly. This will give you an indication of which learners require remediation and extension. Go through the answers to Activities 2, 3 and 4 as a class. Learners can mark their own work or swap books and mark one another's answers. You could record their marks for continuous assessment.

Finding direction

Teaching guidelines

- Explain the concepts of *direction* and *bearing*. Discuss direction in the learners' immediate environment. Ask them to tell you where north, south, west and east are in relation to where they are sitting in the classroom.
- If possible, show learners a compass.
- Use Figure 4.1.12 in the Learner's Book to point out the 16 compass points.
- Explain that when you give compass directions there is a point you measure *from* and a point you measure *to*. If possible, do some example with the learners using a wall map.
- Go through the steps on how to measure bearing. Use Figure 4.1.13 to assist you.
- Do a few practice examples on the board or using the map the learners are working from. Make sure that learners understand to measure from north in a clockwise direction.
- Explain the concepts of *magnetic north*, *true north* and *magnetic declination*.
- Point out the magnetic declination on the pull-out topographic map.
- Explain that each degree can be divided into 60 minutes ('), and that the magnetic declination is stated in degrees and minutes.
- Do a worked example to calculate magnetic declination on the board.
- Then, explain that to find the magnetic bearing, we simply add the magnetic declination to the true bearing that we measured with a protractor. Do an example on the board.
- Learners work through Activity 5 in pairs. Ensure that any learners with visual impairments work with a sighted learner who can assist them.

Homework

Activity 5 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 5 **(LB page 246)**

1. a) **i)** NNE
ii) WSW (W)
iii) WSW (W)
iv) SW
v) NE

b) Accept a variance of 4°:
i) 9° **ii)** 260° **iii)** 265°
iv) 230° **v)** 54°

2. a) Accept a variance of 4°.
i) Direction: West
True bearing: 269°
ii) Direction: South-west
True bearing: 210°
iii) Direction: East south-east
True bearing: 108°
iv) Direction: North north-west
True bearing: 327°

b) This will vary depending on the current year.
Sample calculation is for 2021
For each additional year, add 0.7'
Map date of declination: 2006
Magnetic declination for 2006: 17°13'
Current year: 2021
Difference in years: 2021 – 2006 = 15 years
Mean annual change: 0.7'
Change from 2006: 0.7' × 15 = 10.5'
Because the change is westwards, we add it to the original declination:
17°13' + 10.5' = 17°23.5'
Therefore, magnetic declination for 2021 = 17°23.5'

c) Magnetic bearing = true bearing + current magnetic declination
= 108° + 17°23.5'
= 125°23.5'

Continuous assessment

Go through the answers to Activity 5 as a class. Learners can swap books and mark one another's work. You could record their marks for continuous assessment.

Identify landforms on maps using contours and symbols

Teaching guidelines

- Revise the different symbols used to indicate height on a map.
- Remind learners that a contour line is an isoline, and that it joins places with the same height above mean sea level. Contour lines are usually drawn at 10 m intervals and every fifth line is bold.

- Use question-and-answer methodology to see whether learners remember that many contour lines close together indicate steep slopes.
- Draw sketches on the board and use the diagrams in the Learner's Book to revise the arrangement of contours for the different types of slopes. Go through the landforms indicated by contour lines, using the illustrations in the Learner's Book.
- Learners complete Activity 6 on their own. However, learners with visual impairments will need to work with a sighted learner who can assist them.

Homework

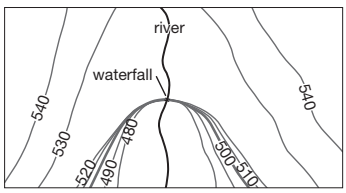
Activity 6 can be finished at home, if necessary.

Suggested answers

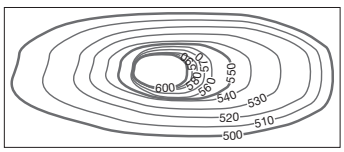
Activity 6 (LB page 250)

1. Example sketches are provided below. Learners' sketches will differ, but should be representative of the features shown in the photographs. The inclusion of contour values of their choice will help to show the direction of slope.

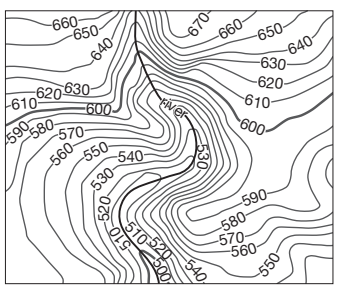
a)



b)



c)



2. A. Saddle
B. *Poort*
C. Concave slope
D. Valley

Continuous assessment

Go through the answers to Activity 6 as a class. Learners can swap books and mark one another's work. You could record their marks for continuous assessment.

Latitude and longitude coordinate system

Teaching guidelines

- Show the learners a globe. Ask them to describe its shape, and comment on their descriptions.
- Revise the ways in which places are located on the Earth's surface. For instance, people can use grid lines, compass direction and compass bearing.
- Show learners a globe or an atlas that has lines of latitude and longitude.
- Ask learners to define the terms *latitude* and *longitude*. Comment on their answers and correct the definitions where necessary. Make sure that the learners understand that these lines are imaginary. We cannot see them anywhere on the Earth's surface. They only appear on maps and globes.
- Mention the most important line of latitude (the equator) and line of longitude (the Greenwich meridian) and state why the equator and the Greenwich meridian are regarded as the most important lines of latitude and longitude respectively.
- Name and point out other lines of latitude, for example the Arctic Circle, Tropic of Cancer, Tropic of Capricorn and Antarctic Circle. Note their values in degrees from the equator.
- Demonstrate how to find the location of a place using latitude and longitude, and have learners practise locating places by reading from a map and by referring to an atlas index.
- Explain that when we give the position of a place on a map, we give the latitude first, and we always state whether a place has a north or south latitude (from the equator) and an east or west longitude (of the Greenwich meridian).
- Describe the features of lines of latitude and longitude.
- Explain how lines of latitude and longitude are divided into degrees, minutes and seconds. Go through the steps for giving coordinates accurately, making use of the text and illustration in the Learner's Book.

- Remind learners that in Namibia latitude will always be south, and longitude will always be east. Stress once again that latitude must always be stated first.
- Learners then work through Activity 7 in pairs. Ensure that any learners with visual impairments work with a sighted learner who can assist them.

Homework

Activity 7 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 7 **(LB page 253)**

1. **a)** 26°28'32'' S; 18°15'05''E
   b) 26°28'34'' S; 18°14'58''E
2. **a)** Health facility
   b) School
   c) Golf course
   d) Airport

Continuous assessment

Walk around the class while learners are doing the activity and assist learners who are having difficulty locating features using latitude and longitude. This will give you an indication of which learners require remediation and extension. Go through the answers to Activity 7 as a class. Learners can swap books and mark one another's work. Learners must then do any corrections. You could record their marks for continuous assessment.

Human activities in relation to the features on a map

Teaching guidelines

- Learners now begin to "read" maps for information about the human and physical landscape. To do this, they must be comfortable with reading map symbols and interpreting relief, as these are the two key ways in which information is obtained from a map.
- Revise the concepts of *primary*, *secondary* and *tertiary activities*.
- Discuss the relationship between natural resources and human activities.
- Show learners how to use topographic maps and the symbols in their keys to identify evidence of human activities.
- Learners can then complete Activity 8 in pairs. Ensure that any learners with visual impairments work with a sighted learner who can assist them.

Homework

Activity 8 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 8 **(LB page 254)**

1. **a)** There is an airport. There are trunk roads and main roads providing access to Keetmanshoop.
   b) There are monuments in the built-up area of Keetmanshoop. There is the Quiver Tree Forest.
   c) The area consists of "barren land" and there is not enough water for growing crops (all water bodies are non-perennial). However, the presence of farm boundaries and boreholes suggest that commercial pastoral farming may take place in this area.
   d) There is a quarry.
   e) Learners' answers may vary. They must be able to justify their answers using evidence from the map, for example: Most people living in the map area are involved in primary activities related to farming, and tertiary activities related to farming and tourism (for example, services such as farm supplies, accommodation, tour guiding and banking). Although farming, a primary activity, may be the main economic activity, this appears to be in the form of large-scale pastoral farming, which employs few people. The small quarry in the north is a primary activity. There may also be agricultural processing activity in the area, which is a secondary economic activity.
2. Mining: Slimes dams, Ngwenya iron ore mine, excavations, diggings
   Farming: Cultivated lands, dams
   Tourism: Nature reserve, track and hiking trail, dam, protected area

Continuous assessment

Walk around the class while learners are doing the activity and assist learners who are having difficulties. Go through the answers to Activity 8 as a class. Learners can swap books and mark

one another's work. Learners must then do any corrections. You could record their marks for continuous assessment.

Interpreting topographic maps

Teaching guidelines

- Discuss ways in which relief, drainage, vegetation, settlement and communication systems are shown on topographic maps using the Keetmanshoop pull-out map.
- Discuss different types of land use and how to identify them on a map. Refer to Table 4.1.4 in the Learner's Book.
- Learners then work through Activity 9 in pairs.

Homework

Activity 9 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 9 **(LB page 260)**

1. a) The elevation of the mapped area ranges from 849 m in the south-west corner of the map to 1125 m in the north-east corner. Transport routes (roads and railways) follow the contour lines, avoiding steep inclines. The built-up area of the town and the air strip are located on flat ground. The highest elevations are located in the Quiver Tree Forest in the north-east of the mapped area. The steepest slopes are located south of the town.

b) The rivers are non-perennial. This tells us that the area receives low rainfall. The main river in the mapped area is the Skaap River. It starts flowing in a southerly direction, and then continues westwards.

c) Roads, railways, airport, churches, monuments, health facilities, schools, police

d) Most people living in the town of Keetmanshoop are involved in tertiary activities related to farming and tourism. For example, people may be employed in tourism service industries such as accommodation and tour guiding, and agricultural services such as selling farm supplies or trading farm produce, such as wool. People will also be employed in related services, such as transport and banking. Although there is no evidence of a manufacturing area, there may be some agricultural processing industries in the area.

e) Barren land cannot be used for agriculture. Nothing grows in barren land as it is too dry.

2. a) Ekulindeni is a more mountainous area than Keetmanshoop. Elevations range from 1187 m to 1648 m. Slopes are much steeper.

b) i) It is a mining settlement.

ii) The black dots indicate rural settlement buildings.

iii) Urban functions include a post office, a store, a place of worship, roads, a school and recreation grounds.

c) There are dams and cultivated land, as well as a lack of barren land.

Continuous assessment

Go through the answers to Activity 9 as a class. Learners can swap books and mark one another's work. You could record their marks for continuous assessment.

Vertical, horizontal and oblique photographs

Teaching guidelines

- This section focuses on the use of photographs to analyse and interpret features. Photographs are classified according to the angle from which they were taken.
- Explain what vertical aerial photographs are, how they are taken, and what they are used for. Refer to Figure 4.1.40 in the Learner's Book and point out some natural and constructed features in the photograph.
- Then, discuss how we also use horizontal and oblique photographs to identify and interpret features. Note that these angles give us a familiar view of objects, making them easier to recognise.
- Show the learners a number of photographs of natural and constructed features taken from different angles. Ask them to say whether they think each photograph was taken from ground level or from an angle above the ground.
- Point out the advantages and disadvantages of horizontal, oblique and vertical photographs using the notes in the Learner's Book.
- Learners then complete Activity 10 in pairs.

Homework

If learners have access to mobile phone cameras, ask them to take photographs of the same thing from different angles and then compare them. Allow them to share their photographs with the rest of the class. Activity 10 can be finished at home, if necessary. Ideally, learners should complete it in class, as they are working in pairs.

Suggested answers

Activity 10 **(LB pages 263–265)**

1. a) i) A. Horizontal B. Oblique
C. Vertical D. Oblique
E. Horizontal F. Oblique
G. Horizontal H. Vertical

ii) A. Natural and human-made: Trees; sign boards, road, road barriers
B. Natural and human-made: Mountains, barren land; road, fence
C. Natural: Desert sand dunes
D. Natural and human-made: Sea, beach; pier, built-up area
E. Natural and human-made: Sea, beach; shipwreck
F. Natural: River, canyon
G. Human-made: Monument, road, pavement, fence, streetlight, grassed area
H. Natural: Sand dunes, trees, salt pans

iii) A. Close-up B. Distance
C. Distance D. Distance
E. Close-up F. Distance
G. Close-up H. Distance

b) In Photograph B, the road is straight as the landscape is flat. It does not need to curve to follow contours. In Photograph D, the city follows the shape of the coastline. A pier has been built out to the sea.

c) The Fish River Canyon has very steep slopes. The tops of the slopes are vertical, suggesting that they are composed of resistant rock. The top of the canyon is at a much higher altitude than the base of the valley. The surrounding landscape is flat, suggesting that the river has eroded downwards into a plateau. The river has deep, incised meanders.

d) The Kuiseb River has a much lower valley with a gentler slope. Meanders are not as pronounced. Both rivers flow through a dry area with little vegetation.

2. a) i) Network of roads; small buildings indicating houses

ii) They are located on flat land.

b) The southern part of the photograph is flat. There is a flat, settled area on the west side of the photograph. The area north of the road is mountainous.

c) Slimes dams, excavations

3. a) The photograph on the left is a distance shot, so it shows a much larger area and gives a broad picture of the saltworks. The close-up photograph on the right shows detail of a specific part of the saltworks.

b) The photograph on the left is taken from an oblique angle. The photograph on the right is a horizontal shot.

4. Namibia is an arid country with very low rainfall. Large areas are covered by desert or semi-desert. Vegetation is very sparse due to the arid climate.

Continuous assessment

Go through the answers to Activity 10 as a class. Learners can mark their own work. You could record their marks for continuous assessment.

Remedial and extension activities

Remedial

1. Some learners may have difficulty orienting a map or interpreting a key. Give the learners a copy of familiar maps, such as a maps of Namibia, Africa, and the world, and ask them to orient the map so that north is at the top.
2. Use other maps in the Learner's Book and ask learners questions relating to the key. For example, refer to the map on page 217 and ask:
   a) What is the symbol for the railway?
   b) What is the symbol for the proposed bypass?
3. Some learners may struggle to calculate distances. Give the learners simple measurements to work with. Point out that multiplying by 0.5 is the same as halving. Remind learners that there are 1 000 m in 1 kilometre. For example:
   a) 10 cm × 0.5 km = 5 km = 5 000 m
   b) 100 cm × 0.5 km = 50 km = 50 000 m
   c) 1 cm × 0.5 km = 0.5 km = 500 m
   d) 6 cm × 0.5 km = 3 km = 3 000 m
   e) 16 cm × 0.5 km = 8 km = 8 000 m

4. Some learners may have difficulty calculating area. Give learners simple shapes and measurements to work with.
5. Some learners may struggle to calculate gradient. Give the learners simple gradients and measurements to work with.
6. Some learners may have difficulty measuring bearing, and reading off the degrees correctly. Do more examples to explain. Ask a Maths teacher to assist you. Repeat the basic definitions and descriptions as given in the Learner's Book.
7. Have a fun Bingo competition. Give each learner a list of six features on the pull-out topographic map. They need to give the grid references for each feature. They shout *Bingo!* when they have completed the task. Check that their answers are correct. You could award a small prize, such as a chocolate, to the winner. You could photocopy the sheet below for each learner.

Location Bingo		
Namib quarry Latitude: _____ Longitude: _____	Rifle Range (.952) Latitude: _____ Longitude: _____	Church in Noordhoek Latitude: _____ Longitude: _____
Intersection of B1 and B4 (.947) Latitude: _____ Longitude: _____	Truppengarten Latitude: _____ Longitude: _____	Monument in centre of Keetmanshoop Latitude: _____ Longitude: _____

8. Give learners a selection of photographs from newspapers, calendars, magazines or any other source available. Ask them to sort the photographs:
   a) into those that show natural features and those that show human-made features
   b) according to the angle from which they were taken
   c) according to the distance from which they were taken.

Suggested answers

2. **a)** A thin solid grey line
   b) A thick dashed blue line
7. Accept a variance of 10". Bear in mind that the quarry and Truppengarten are areas, and not defined points.

Location Bingo		
Namib quarry Latitude: 26°29'15" Longitude: 18°08'22"	Rifle Range (.952) Latitude: 26°35'08" Longitude: 18°11'15"	Church in Noordhoek Latitude: 26°34'05" Longitude: 18°08'20"
Intersection of B1 and B4 (.947) Latitude: 26°35'42" Longitude: 18°08'25"	Truppengarten Latitude: 26°36'50" Longitude: 18°11'25"	Monument in centre of Keetmanshoop Latitude: 26°34'45" Longitude: 18°08'

Extension

1. Learners can use the scale of Figure 4.1.1 in the Learner's Book to calculate the distance between different cities.
2. Give learners additional straight- and curved-line distances to measure on the pull-out topographic map. Allow them to work in pairs and set one another different distances to calculate.
3. Learners work in pairs. They draw composite shapes for one another similar to the Figure 4.1.8 shape on page 240 of the Learner's Book, and then calculate the area.
4. Learners work in pairs. They use the pull-out topographic map to give each other more gradients to calculate.
5. Ask learners to do the back bearings between the places listed in Activity 5 Question 1, that is:
   a) from Tsumeb to Windhoek
   b) from Walvis Bay to Windhoek
   c) from Windhoek to Gobabis
   d) from Windhoek to Katima Mulilo
   e) from Mariental to Lüderitz.
   Ask learners what they notice about the relationship between the forward and

backward bearings. (Add or subtract 180° from your forward bearing to get your back bearing. You want the result to fall between 0° and 360°, so if the forward bearing is less than 180°, add 180° to it, and if it is greater than 180°, subtract 180°.)

6. Learners work in pairs. They must pretend they are walking east along district road D609 through the built-up area of Keetmanshoop. They must describe to each other what they think they will see, based on their interpretation of the map symbols.

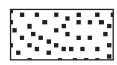
Suggested answers

5. **a)** ±189°
   b) ±80°
   c) ±85°
   d) ±50°
   e) ±234°

Self-assessment (LB pages 268–269)

Topic 4.1 Interpretation of topographic maps

1. **a)** The relationship between the actual size of something and its size on a map (1)
   b) The angle of slope of the land, a measure of how steep a slope is (1)
   c) The position of one place in relation to another (1)
   d) The angle between two points measured clockwise from true north, which is taken as 0° (1)
   e) The angle between true north and magnetic north. (1)

2. **a)**  (1)

   b)  (1)

   c)  (1)

   d)  (1)

   e) 

   (1)

3.

Vertical photographs	Oblique photographs	Horizontal photographs
Learners' answers may vary. Accept any two of the following: • It is hard to tell how tall mountains or buildings are because the photographs are taken from straight above. • Different features have different tones, textures and shapes that make them identifiable. • Natural features have irregular or uneven shapes, for example, rivers wind and bend and tributaries normally join the main river at acute angles. • The bends and turns in roads and railways, which are constructed features, will be more regular. Roads will often intersect at right angles and have a lighter tone than rivers.	Learners' answers may vary. Accept any two of the following: • Oblique photographs are taken with the camera pointed at an angle from the vertical. If the angle is small, we call it a low oblique photograph. If it is large, it is a high oblique photograph. • Oblique photographs show a greater area than horizontal photographs. It is easier to recognise objects in oblique photographs than in vertical photographs. • These types of photographs give us an indication of the height of objects, which makes them easier to understand. • The scale is distorted. Objects in the foreground appear bigger than they are, and objects in the background appear smaller. High objects in the foreground obscure objects behind them.	Learners' answers may vary. Accept any two of the following: • Horizontal photographs are taken when the camera is horizontal to the ground. They are taken from ground level and show us what we would see if we were looking at the object while standing on the ground. • They show us a familiar view in which we can recognise features easily. They are cheap and easy to produce because they are taken at ground level. • Objects in the foreground block the objects in the middle ground and background. Horizontal photographs cover a small area. Objects that are not in the centre of the foreground may be out of focus. The scale decreases from the foreground to the background.

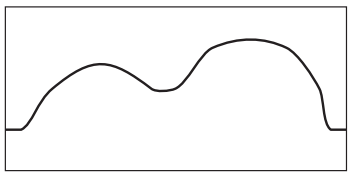
(6)

4. a) Direction: North north-east
True bearing: ±34° (2)

b) Direction: East south-east
True bearing: ±97° (2)

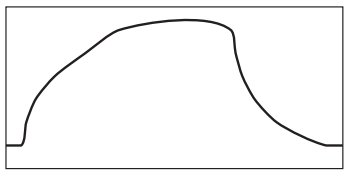
c) Direction: South-east
True bearing: ±123° (2)

5. a)



(3)

b)



(3)

6. a) i) VI = 1 032 – 880
= 152 m
HD = ±11.8 cm × 500 m
= ±5 900 m
$G = \frac{152\text{ m}}{\pm 5\,900\text{ m}}$
$= \pm\frac{1}{38.8}$ or 1:38.8 (3)

ii) VI = 1 010 – 953
= 57 m
HD = ±15 cm × 500 m
= ±7 500 m
$G = \frac{57\text{ m}}{\pm 7\,500\text{ m}}$
$= \pm\frac{1}{131.6}$ or 1:131.6 (3)

b) The first gradient is much steeper than the second gradient. (2)

c) i) 26°5'S; 18°8'45''E (2)

ii) 26°38'28''S; 18°5'26''E (2)

d) i) ±28 cm × 0.5 km = ±14 km (2)

ii) ±24.2 cm × 0.5 km = ±12.1 km (2)

7. a) It is located on flat land close to the built-up area of Keetmanshoop. (3)

b) The relief of the northern part of the map is flatter than in the southern part of the map. The only part of the northern section that has any significant slopes is the Quiver Tree Forest. (4)

c) Keetmanshoop is serviced by two trunk roads (the B1 and B4), two main roads (the C16 and C17), a district road (D609) and several other roads, which connect it to the north, east, south and west. It is also serviced by a single-track railway, with sidings, and an airstrip. All of this suggests that Keetmanshoop is well-integrated into the national transport system and is an important transport hub. The presence of a railway siding and airstrip suggest that it is economically important, and/or that some form of primary or secondary industrial activity takes place here that requires rail transport. (4)

d) Learners' answers will vary.
For example:

i) I will transport the tourists by bus. (1)

ii) We will visit the monuments and historic churches of Keetmanshoop. We will take a slow drive up to the Quiver Tree Forest and observe the barren landscape en route. (3)

iii) The trip will last two days. One day will be spent in the town, and the other day will be spent exploring the Quiver Tree Forest and its surroundings. (3)

iv) Tourists should bring water, cameras, sunblock and hats, and wear cool clothing. (3)

8. a) It is a horizontal photograph. (1)

b) The river flows through a flat valley. There are trees and grass along the banks. There is a lot of water in the river. This is a wet area. (4)

c) Lower stage. There is a large, flat floodplain, river flow is laminar and the river appears to be meandering across the floodplain. (4)

9. a) Waste dump (1)

b) Mining/quarrying (1)

c) Urban settlement (1)

d) Learners' answers may vary. Accept any three of the following or other suitable answer:

- Chemical and solid-waste pollution from the waste dump
- Siltation from the quarry
- Chemical pollution from the industrial area in the middle ground of the photograph
- Pollution from urban runoff. (3)

Total: 80 marks

Section C Additional resources

Practice examinations memoranda (LB pages 270–278)

Paper 1

Section A: Physical geography

1. a) Convergent (destructive) (1)

b) A. Continental plate (1)
B. Mantle (1)
C. Descending plate (1)
D. Oceanic plate (1)
E. Subduction zone (1)

c) i) Peripheral fold mountains would be found on the land/continent that lies adjacent to the ocean. (1)

ii) A trench would be found in the ocean close to the land/at the subduction zone. (1)

d) Learners' answers may vary. Accept any suitable answer, for example: This process is occurring on the western side of South America and has led to the development of the Andes Mountains. (2)
[10]

2. a) Accept any suitable suggestions, for example:
This disaster occurred because there had been heavy rain. The dam wall was unstable and it collapsed due to the great volume of water. Drought in the area had reduced the vegetation and this allowed more water to flow over the land and into the dam. (3)

b) A mudflow is similar to a river of mud. Mudflows occur when water saturates a slope with a high clay content, resulting in a liquid mix of water and sediment that flows rapidly downhill. (2)

c) People were killed and injured by the flowing mud. Many homes were swept away or damaged. (2)

d) Afforestation creates a permeable surface that allows water to infiltrate the soil, so less water flows into rivers and dams. Vegetation also slows the runoff and so water does not flow rapidly over land into the rivers and dams. The roots of the trees and plants bind the soil, reducing erosion, and therefore the amount of sand and silt that reaches dams and rivers. Sand deposited in rivers and dams reduces their carrying capacity (siltation). Afforestation is a sustainable measure, as it is a natural intervention that does not involve hard engineering techniques that disrupt the natural processes of a drainage basin. (3)
[10]

3. a) Insolation (1)

b) Incoming radiation is mainly in the form of short waves. Terrestrial radiation is in the form of long waves. (2)

c) Gases such as water vapour, carbon dioxide and methane absorb the long-wave radiation emitted by the Earth's surface. (1)

d) Sensible heat is the actual heat that you feel, or the actual heat of an object or gas. Sensible heat transfer happens through either conduction or convection. Conduction is when heat is transferred from the warm Earth to the atmosphere with which it is in contact. This transfer of sensible heat then continues from the gases of one layer of the atmosphere to the layer of gases above it. Convection is when heat energy is transferred from one area to another by the movement of gas (the atmosphere) or fluid (the ocean). In the atmosphere, hot air rises and cool air sinks. The cool air is then warmed by the Earth's surface via conduction.
Latent heat is "hidden" heat. It is the heat that is absorbed or released when a substance changes from one state to another. When liquid water changes to water vapour (evaporation), heat energy is absorbed from the surrounding air. This cools the

surrounding air. When water vapour condenses, latent heat is released and this warms the surrounding air. (6)
[10]

Section B: Economic activities and the use of resources

4. a) Intensive, as the available land is limited due to the proximity to the city. It is also close to the market (city). (2)

b) Learners' answers may vary. Accept any two of the following: Seeds, fertiliser, herbicides and pesticides, equipment. (2)

c) Learners' answers may vary. Accept any of the following or other suitable answer: Canned produce, frozen produce, chopped and cut packets of produce, ready-made meals. (1)

d) Learners' answers may vary. Accept any of the following or other suitable advantage:
- Factories provide employment opportunities and skills training for many people.
- They earn much more in taxes for the government than smaller industries.
- Rural factories help prevent rural–urban migration.
- They can stimulate the establishment of other local businesses to provide services the factory needs.
- Factories' production costs are low, because they produce high numbers of products. (1)

Accept any of the following or other suitable disadvantage:
- Factories may cause small-scale businesses to close down, because factory machinery can produce goods faster and more cheaply than when they are handmade.
- If raw materials become unavailable, the factory has to close down, which can negatively impact a country's economy.
- A factory that closes may cause other local businesses (those that provide services to it or to its employees) to suffer, or also close down.
- Factories produce a lot of waste, and can be a source of air, water and soil pollution. (1)

e) Learners' answers may vary. Accept any of the following or other suitable answer:
- Siting: The factories are on flat land, which is easier to build on. They are grouped together and so can supply each other with inputs.
- Labour: The factories are close to the city, where a large supply of employees can be found.
- Raw material: If they process produce, they are close to the source of their raw material.
- Energy: There is a coal power station that supplies electricity.
- Transport networks: There are enough well-maintained roads.
- Market: It is close to a city. (2)

f) They use solar panels to generate or supplement electricity. (1)
[10]

5. a) Gas, nuclear, wind/solar (3)

b) 2015: ±26%; 2040: ±20%. Therefore, an expected decrease of ±6%. (2)

c) The world's supply of coal is decreasing, as it is a non-renewable resource. Burning coal also damages the environment, for example, it contributes to global warming and acid rain. (2)

d) Learners' answers may vary. Accept any of the following: Water/hydroelectric power, biogas/biomass, geothermal, tides, waves. (1)

e) Learners' answers may vary. Accept any two suitable reasons, for example: Large regions of southern Africa receive a lot of sunlight. Many rural areas of southern Africa are not supplied with electricity. Small solar panels can provide these homes with power. (2)
[10]

6. a) Climate (some areas have high levels of evaporation and low levels of precipitation), climate change (climate change is altering global rainfall patterns) and geology (some areas do not have groundwater stores due to the geology of the area) (3)

b) Learners' answers may vary. Accept any of the following or other suitable answer:
- Agriculture: Without food, people go hungry and suffer from malnutrition. This means they are not strong enough to work or farm productively, and so yields are low and there is little surplus for sale or income to reinvest in farming. Farmers remain poor and their food supply never improves. Children also cannot learn well when they are hungry, so they lack education.
- Education: Children do not have enough time to attend school and to study. They therefore lack skills and cannot pursue tertiary education. They can then only find employment in low-paying jobs, and so remain poor. Their own children in turn often need to sacrifice their educations to help support the family.
- Health: People in poor health often become too ill to work, and so they cannot generate an income. Ill children miss school and cannot study effectively, so they do not attain a good education and cannot find high-paying employment. They stay poor. (2)

c) Learners' answers may vary. Accept any of the following or other suitable answer:
- With more water, people can increase their agricultural yields enough to sell a surplus and make an income. This money can be reinvested in the farm, for example, they can buy farming equipment, which will further increase the surplus.
- Children no longer need to miss school to fetch water and can therefore obtain a good education and find a high-paying job that allows them to break the cycle of poverty. (2)

d) Learners' answers may vary. Accept any of the following or other suitable answer: Kunene River, Okavango River, Orange River. (1)

e) Learners' answers may vary. Accept any of the following or other suitable answer: Hardap Dam, Von Bach Dam, Swakoppoort Dam, Uanob Dam. (1)

f) Learners' answers may vary. Accept any of the following or other suitable answer: The maize triangle, Stampriet, Hardap scheme, Aussenkehr. (1)

[10]

Section C: Human geography

7. a) Japan's population pyramid has a narrower base than Egypt's. Between ages 0 and 14, Japan's population increases (the base wides), while Egypt's decreases (the base narrows). There is little difference between the number of male and female children aged 0 to 4 years in Japan. However, there are almost half a million more male children aged 0 to 4 years in Egypt. (3)

b) Learners' answers may vary. Accept any two of the following or other suitable answer:
- Japan is a developed country with good medical services and so the infant mortality rate is low. Egypt is a developing country, so medical services might be poorer and infant mortality rates higher.
- Japan has high levels of education among females, so women are more likely to pursue careers than to start a family. Levels of education, especially among women, might be lower in Egypt.
- Japan provides education in family planning and access to contraceptives. Religions and cultures in Egypt prevent or discourage the use of contraceptives, leading to higher birth rates. (2)

c) Japan is in Stage 5 (High declining), because the birth rate, infant mortality rate and death rate are all low; life expectancy is high; and the birth rate is lower than the death rate. (5)

[10]

8. a) i) Rural–urban migration/Urban–rural migration (1)

ii) Commuting/Migrant labour (1)

b) i) There are jobs available in the mining area, for higher pay, while

few jobs are available in the rural village. There also may be a lack of available farmland surrounding the village due to high birth rates and low death rates. (2)

c) Learners' answers may vary. Accept any two of the following positive effects or other suitable answer:
- Migrants learn new skills that they bring back to their place of origin, if they return home.
- Families that remain in the place of origin receive remittance (money) that migrants send back home.
- Migrants return home financially independent, if they have managed to save large sums of money.
- Unemployment is reduced in the place of origin.
- The birth rate may decrease. (2)

Accept any two of the following negative effects or other suitable answer:
- Male family members often migrate in order to earn an income to support their families. This leads to long periods of disrupted family life and young children having to grow up without their fathers.
- Mostly young males are sent to find work in order to support their families. This results in a loss of young male workers.
- When educated and skilled people migrate to other countries, their country of origin loses educated and skilled workers.
- Labour shortages may arise in some areas of employment.
- There are few young people left to farm, so agricultural productivity declines.
- As more people leave, more services close, further decreasing available jobs and pushing more people away. People who remain cannot obtain an education or healthcare. (2)

d) i) Destination countries favour younger people of working age, as they are more likely to obtain a job, earn an income and pay taxes, and to contribute to the economy. Young dependants are seen as a burden to the country, as they require schooling and financial support, while older dependants require healthcare and old-age support. (1)

ii) Destination countries favour well-educated people, as they can contribute most to the economy and are less likely to become dependant on the state. (1)

[10]

9. a) Okono is a <u>rural</u> <u>nucleated</u> settlement. (2)

b) Learners' answers may vary. Accept any two of the following physical factors or other suitable answer:
- Okono is situated at a *poort*, which forms a natural transport restriction, so the town may be a break of bulk point.
- It is located beside a permanent river, providing water for development and growth.
- It is located on a flat gradient, making it easier to construct buildings and farm crops in the area. (2)

Human factor: Okono is located at the junction of two roads, providing trade and transport links. (1)

c) Linear (1)

d) Accept any suitable answer with examples, for example:
Large cities can introduce measures such as those used in Singapore, for example, provide well-organised and functional public transport such as underground rail, electric rail or buses; install computerised traffic management systems; make it more expensive to purchase and drive a car in the city by limiting the number of vehicle licenses; and introduce electronic toll road pricing for certain areas of the city, which can also be increased during peak hours. Other solutions include building bicycle lanes, creating pedestrian-only streets, providing public transport apps that help people to find the fastest way to travel between locations, encouraging car-sharing. (4)

[10]

Total: 100 marks

Paper 2

Section A: Physical geography

1. a) A divergent plate margin is where tension forces are causing two plates to move away from each other. A convergent plate margin is where compression forces are forcing two plates to move towards each other. A conservative plate margin is where two plates are sliding past each other. (3)

b) It is a divergent plate margin. Tension forces caused by convection currents in the mantle pull the North American Plate and the Eurasian Plate apart. The convection currents in the mantle cause hot, molten material to rise at the Mid-Atlantic Ridge. The magma cools and solidifies, forming new crustal material at the ridge. (4)

c) The African Plate is splitting into the Nubian Plate and the Somali Plate. Millions of years ago, tension and upwelling of magma along this developing plate margin caused east Africa to form a dome. The crust on the top of the dome stretched, and faults developed. The East African Rift Valley was created as land slipped down between faults, forming two branches of rift valleys on either side of Lake Victoria. Block mountains are found between the two branches. The development of the Iceland Rift Valley began millions of years ago when Europe and North America separated, creating two plates – the Eurasian Plate and the North American Plate. Magma that extruded along the ridge created the land mass known as Iceland. The rift valley across Iceland occurs where the Mid-Atlantic Ridge extends across Iceland. The tension forces that cause the plates to diverge created faults and the land has slipped down between the faults. (8)

d) Volcanic soil is fertile and so the area supports the growing of crops. Tourism in the area has developed due to the scenic nature of volcanic mountains. This brings money into the region and provides local people with jobs. Geothermal power is used in volcanic areas to produce electricity. However, volcanic activity is a hazard for the people and may result in loss of life, damaged homes, loss of crops, and so on. (6)

e)
- Learners' answers may vary. Accept any two of the following lakes or other suitable answers: Lake Tanganyika, Lake Malawi, Lake Kivu, Lake Edward, Lake Albert.
- Learners' answers may vary. Accept any one of the following volcanic mountains or other suitable answer: Mount Kilimanjaro, Mount Kenya, Mount Ngorongoro
- Block mountain: Rwenzori Mountain Range (4)

[25]

2. a) *P* represents precipitation, *Q* is runoff (stream flow) and *E* is evaporation and transpiration. (3)

b) This area is in the northern hemisphere. Most rain falls from November to March, which are the winter months in the northern hemisphere. Figure B shows that there is some rain between April and October, so rain falls all year. (2)

c) May to July (2)

d) There is a water deficit in August and September. (2)

e) Evaporation of moisture from the soil is greater than the rainfall that the soil receives. (2)

f) Evaporation of moisture is less during the cool winter months, and rainfall exceeds evaporation. (2)

g) i) The water table (1)

ii) Base flow (1)

h) There is more runoff of rain on steep slopes, so there will be less infiltration than on gentle slopes. Infiltration is greater if soils are porous and permeable. Infiltration is lower in soils that are already moist, but if the soil is dry there is a lot of infiltration.

The vegetation in farming areas and rural areas slows rainwater flowing over the land and allows for more infiltration. Many surfaces in urban areas are impermeable, for example, the concrete and tar roads, thus there is less infiltration and more runoff in these areas. (8)

i) People know how much water is available in the soil for agriculture, what time of year they should irrigate their crops, and how much water is needed when they do so. (2)

[25]

Section B: Economic activities and the use of resources

3. a) Deforestation (1)

b) Removal of trees causes the soil to become unstable, as the tree roots no longer hold the soil in place. Rainfall then leads to erosion. If deforestation takes place on a steep slope, as is the case in Figure C, heavy rainfall can result in the soil becoming saturated and so overcoming the force of friction, resulting in slope collapse (a mudflow). Furthermore, deforestation reduces the number of trees, and because fewer plants exist, less carbon dioxide is taken from the atmosphere. This contributes to global warming and climate change. (3)

c) Accept any of the following or other suitable answer:

- Industries: To clear land for buildings, mining operations and infrastructure; to obtain wood for making products
- Farmers: To clear and level land for growing crops, as well as to create grazing land for animals. (2)

d)

- It makes land usable, as crops can be planted and animals kept for food.
- It contributes to food security, as subsistence farmers are able to support themselves and are less vulnerable when food costs increase.
- It makes it possible for people to earn an income, because any excess produce can be sold. (6)

e) Manufacturing industries decrease unemployment, because they create jobs for many people. If people have work, they can afford more things and their quality of life improves. People buying more goods also stimulates the economy. Employees learn skills they can use to get better jobs and earn better salaries. When people earn higher salaries, the government receives more tax revenue, which can be used to improve the country's services and infrastructure. Industries may manufacture products that the country can export, which brings foreign currency into Namibia. (6)

f) Industries release toxic chemicals and farmers use fertilisers, herbicides and other chemicals that infiltrate the soil, and can also contaminate the groundwater. Industries emit large amounts of toxic gases into the atmosphere, which are hazardous to people, animals and plants. Many of these gases are also greenhouse gases, which contribute to global warming. Pastoral farming in particular is responsible for the emission of huge amounts of gases such as the greenhouse gas methane. Many industries dump toxic chemicals into water bodies and so pollute the water. The chemicals used in farming are carried to streams, rivers and dams, where they often cause eutrophication. This kills all plant and animal life in the water. (6)

g) Conservation agriculture is a set of soil management practices that improve and maintain the soil quality, regenerate degraded soil and reduce soil erosion. (1)

[25]

4. a) Renaissance (under planning), Roseires, Sennar (3)

b) Learners' answers may vary. Accept any two suitable answers, for example:

- Egypt and Sudan are desert countries. They receive less than 300 mm of rainfall annually.

All three countries are hot with average temperatures above 20 °C.
- All countries need access to fresh water for daily consumption, to irrigate crops and for industry. (4)

c) Learners' answers may vary. Accept any four of the following or other suitable answer:
- The dam could result in less flooding during the rainy season.
- Hydropower could reduce the region's dependence on fuelwood and non-renewable sources of power generation.
- The construction of the dam will flood large areas of natural vegetation and destroy local ecosystems.
- The dam will change the types of fish found in the area.
- It will change the temperature and sediment load of the water downstream of the dam.
- Less sediment will result in more erosion downstream.
- Less water will flow in the river downstream of the dam, and the natural flow regime of the river will be changed.
- An increase in agriculture could lead to eutrophication of the river water.

Learners' answers may vary. Accept any four of the following or other suitable answer:
- People will be able to grow and irrigate crops.
- They will be able to grow grass for grazing land.
- They will be able to fish for food and an income.
- The dam may be used for recreation.
- It may attract tourists to the area, creating jobs and a source of income.
- The dam could also be a source of hydropower.
- Constructing the dam will flood the area, and may displace people, any villages and farms in that location.
- The dam could also reduce the downstream flow of water, reducing access to water for people downstream of the dam.
- It will reduce the amount of sediment deposited by the river downstream of the dam, resulting in less fertile soil for agriculture. (8)

d) Khartoum (1)

e) Egypt is a desert country in need of water. The building of the Renaissance Dam will reduce the amount of water flowing downstream, where Egypt is located, and the water levels in Egypt's Aswan Dam. This could impact on Egypt's water security, the country's ability to generate hydroelectricity, and the amount of water available for crop irrigation and industry, decreasing food production and slowing economic development. Lower levels of water in the Nile may affect water transportation, which is an important mode of transport in Egypt, as well as disrupt Egypt's fishing and tourism industries. Additionally, damming the upper Nile could reduce the amount of fertile soil carried to the Nile River Valley. (5)

f) Desalination of the Red Sea, digging of wells (2)

g) Lake Victoria, Lake Kyoga (2)

[25]

Section C: Human geography

5. a) Learners' answers may vary. Accept any suitable answer that compares the three countries and makes use of the data, for example:
Kenya has the lowest median age (19.0 years), while the Democratic People's Republic of Korea has the highest median age (34.0 years). Brazil's median age is 12.3 years higher than Kenya's. The Democratic People's Republic of Korea's median age is 3.7 years higher than Brazil's. The Democratic People's Republic of Korea's median age is 15 years higher than Kenya's. (6)

b) Brazil, Kenya, Democratic People's Republic of Korea (2)

c) A higher literacy rate results in a higher life expectancy. The Democratic People's Republic of Korea

has the highest literacy rate (100%), and also the highest life expectancy (68.9 years), while Kenya has the lowest literacy rate (78.0%) and the lowest life expectancy (59.5 years). (4)

d) i) The male/female ratio is the ratio of males to females in a population. It describes the number of males for each female in a population. (2)

ii) Kenya, as there is one male for every female (1)

e)
- Kenya has a low median age, meaning that it has a higher birth rate compared to the other two countries. This suggests that fewer people have access to doctors and medical advances. Kenya also has a relatively low literacy rate, suggesting that it is a country with less development than the other two. Kenya is therefore most likely in Stage 2/Early expanding.
- Brazil has a higher median age (31.3) than Kenya (19), as well as a higher literacy rate (92.6 compared to 59.9) and life expectancy. The country is either in Stage 2/Early expanding or Stage 3/Late expanding.
- The Democratic People's Republic of Korea has a higher median age than Brazil, meaning it has a lower birth rate. It also has a high life expectancy and a very high literacy rate, suggesting that it is highly developed. The country is likely to be in either Stage 3/Late expanding or Stage 4/Low stationary. (8)

f) i) Brazil (1)

ii) The median number is the middle number in a series of values. The median age is therefore the age that divides the population into two equally sized groups. Half of the population is older than the median age, and half is younger. (1)

[25]

6. a) i) Africa's urban population increased by 28.9% from 1950 to 2020. The smallest increase was from 1950 to 1970 (8.3%), while the largest increase was from 1990 to 2020 (11.7%). (2)

ii) North America's urban population increased by 19.7% from 1950 to 2020. The smallest increase was from 1970 to 1990 (1.6%), while the largest increase was from 1950 to 2070 (9.9%). (2)

b) In 1950, Oceania's urban population percentage (62.5%) was much higher than Asia's (17.5%). From 1950 to 2020, Asia's urban population percentage increased by 34.1%, much more than Oceania's urban population percentage, which increased by 8.6%. Asia's urban population percentage experienced its largest increase between 1990 and 2020 (19.3%). Oceania's urban population percentage experienced its largest increase between 1950 and 1970 (7.7%). Asia experienced its slowest rate of urbanisation between 1950 and 1970, with Asia's urban population increasing by 6.2%. Oceania's total urban population appears to have stabilised after 1970, with the urban population increasing by just 0.1% between 1970 and 1990, and by 0.8% between 1990 and 2020. (4)

c) In 1990, almost three-quarters (72.4%) of the population in more developed regions were already living in urban areas, so urbanisation was already high in these regions compared the less developed regions (34.9%). The rate of urbanisation in more developed regions has since begun to stabilise at a high level, as population growth has slowed down. There has also been a trend of counter urbanisation in more developed countries. (5)

d) i) Learners' answers may vary. Accept any city or town in a LEDC, for example: Windhoek is experiencing rapid urbanisation. (1)

ii) Most people moving into urban areas in LEDCs are from rural areas, and are not highly educated. Many of them cannot find a good job,

resulting in a high unemployment/ underemployment rate. Unemployment, high urban property prices and lack of urban housing makes it difficult for many people to buy or rent accommodation, resulting in the growth of informal settlements. Healthcare and educational services are not able to meet the demand of the large influx of people. A lot of pressure is placed on water, sanitation, transport and electricity services, causing them to deteriorate. The lack of clean water and sanitation can result in outbreaks of diseases such as cholera. Crime, prostitution and homelessness increase. During winter months, there is a high risk of fire, as people depend on wood or gas fires for heating and cooking. (7)

e) Asia shows the largest increase from 1990 to 2020 (51.6% – 32.3% = 19.3%). (2)

f) Europe (6.8%) (1)

g) 1990–2020 (14.7%) (1)

[25]

Section D: Interpretation of topographic maps

7. a) Each unit on the map represents 50 000 of the same units on the ground. (2)

b) 10 m (1)

c) A = B × H
B = ±16.5 cm × 0.5 km = ±8.25 km
H = ±13.2 cm × 0.5 km = ±6.6 km
A = ±8.25 km × ±6.6 km = ±54.45 km^2 (3)

d) ±17.7 cm × 0.5 km = ±8.85 km (2)

e) VI = 993 – 884
= 109 m
HD = 6.4 cm × 500 m
= 3 200 m

$$\text{Gradient (G)} = \frac{\text{Vertical interval (VI)}}{\text{Horizontal distance (HD)}}$$
$$= \frac{109 \text{ m}}{3\,200 \text{ m}}$$
$$= \frac{1}{29.36} \text{ or } 1{:}29.36 \quad (4)$$

f) South-east (1)

g) 303° (2)

h) The lowest elevation is along the river (which flows from ENE at 900 m to WSW at 880 m) and the land slopes up on either side of the river, forming a valley with gentle sides. The river also forms a *poort* in the hill that extends from the north-west to the south-east. This hill has a maximum elevation of 1 021 m north-west of the river and 1 000 m to the south east of the river. These hills have had a number of valleys and ridges carved by river drainage. There are also some scattered conical hills in the area. The steepest slopes are those of the conical hills in the north-east. (3)

i) Transport routes (roads and a railway) follow the contour lines, avoiding steep inclines. There is a trunk road and a single-track railway line running across the southern portion of the map. These both follow the course of the river (as it offers the least undulating terrain). There are also smaller Other roads, and a number of tracks. Two of the Other roads cross the river, connecting the settlements to the south of the river with Gobas, the railway line and the trunk road. The Other road that leads north-east from the trunk road also skirts around the steep relief of the hills. (3)

j) (This will vary depending on the current year. Sample calculation is for 2021.)
For each additional year, add 0.7'
Map date of declination: 2006
Magnetic declination for 2006: 17°13'
Current year: 2021
Difference in years: 2021 – 2006 = 15 years
Mean annual change: 0.7'
Change from 2006: 0.7' × 15 = 10.5'
Because the change is westwards, we add it to the original declination:
17°13' + 10.5' = 17°23.5'
Therefore, magnetic declination for 2021 = 17°23.5' (3)

k) Scattered buildings/informal settlements (accept station buildings) (1)

[25]

Total: 100 marks