Mind the Gap! Geography Study Guide Grade 12

The Mind the Gap study guide series assists you to make the leap by studying hard to achieve success in the Grade 12 exam.

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Ministerial foreword

The Department of Basic Education has pleasure in releasing the series called Mind the Gap study guides for Grade 12 learners. The first subjects in the series include Life Sciences, Accounting, Economics and Geography. These study guides are another innovative and committed attempt by the Department of Basic Education to improve the academic performance of Grade 12 candidates in the National Senior Certificate (NSC) exam.

The Mind the Gap study guide series is produced in both English and Afrikaans to assist those learners that have been underperforming due to a lack of exposure to the content requirements of the curriculum. The series aims to mind-the-gap between failing and passing, by bridging-the-gap in learners’ understanding of commonly tested concepts so candidates can pass.

The Mind the Gap study guide series takes its brief in part from the 2011 National Diagnostic report on learner performance. The marking and moderation process has revealed that candidates consistently perform poorly in certain basic concepts. The Mind the Gap study guides also draw on the Grade 12 Examination Guidelines.

Each of the Mind the Gap study guides provide explanations of key terminology, simple explanations and examples of the types of questions that learners can expect to be asked in an exam. Model answers are included to assist learners in building their understanding. Learners are also referred to specific questions in past national exam papers and exam memos that are available on the Department’s website – www.education.gov.za

The study guides have been written by subject expert teams comprised of teachers, examiners, moderators, subject advisors and subject coordinators. All that is now required is for our Grade 12 learners to put in the hours studying hard for the exams. It should be remembered that the support of the teachers and parents is also of utmost importance as they are responsible for supporting the learning process at school and at home.

It is my fervent wish that the Mind the Gap study guide series takes us all closer towards ensuring that no learner is left behind.

Learners make us proud – study hard. We wish you all good luck for your Grade 12 exams.

Matsie Angelina Motshekga, MP
Minister of Basic Education
July 2012

Mr Enver Surty, MP
Deputy Minister of Basic Education
July 2012
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Dear Grade 12 learner

This Mind the Gap study guide helps you to prepare for the end-of-year Geography Grade 12 exam. The study guide does NOT cover the entire curriculum, but it does focus on core content of each knowledge area and points out where you can earn easy marks. You must work your way through this study guide to improve your understanding, identify your areas of weakness and correct your own mistakes. To ensure a high-quality pass, you should also cover the remaining parts of the curriculum using other textbooks and your class notes.

We are confident that this Mind the Gap study guide can help you to prepare well so that you pass the end-of-year exams.

Overview of the exam for Geography Grade 12

<table>
<thead>
<tr>
<th>Paper 1 (Theory exam)</th>
<th>Paper 2 (Mapwork exam)</th>
</tr>
</thead>
</table>
| • You are given four questions of 100 marks each in Paper 1. You are expected to answer only three questions. Make sure you don’t repeat a question. | • Question 1 – Multiple-choice (mapwork calculations and some interpretation): Read each option carefully to avoid careless mistakes.
| • Carefully read through all the questions on a topic, including referring to the diagrams in the addendum, before you start to answer the sub-questions. Look out for clues (hints) that could help you to answer the questions. | • Question 2 – Mapwork skills and calculations: Write the formula down for each calculation and show all workings for all calculations, as marks are awarded for these steps.
| • Use a black or blue pen to write your answers. Diagrams should be done in pencil only. | • Question 3 – Interpretation of the map using your theory knowledge: Study the map carefully, especially the blocks mentioned in the question (e.g. D3), for clues that could help you answer the question.
| • Always use point form when answering questions, except if you are asked to write a paragraph, e.g. if a question says: ‘Write a paragraph of no more than 12 lines...’ | • Question 4 – GIS knowledge: Carefully study your map, including the reference key, to answer the questions in this section.
How to use this study guide

This study guide covers selected aspects of the different topics of the Grade 12 Geography curriculum in the order that it is usually taught during the year. The selected aspects of each topic are presented in the following way:

- An explanation of terms and concepts
- Worked examples to explain and demonstrate
- Activities with questions for you to answer
- Answers for you to use to check your own work

<table>
<thead>
<tr>
<th>Pay special attention</th>
<th>Hint</th>
<th>Worked examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hints to help you remember a concept or guide you in solving problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step-by-step instructions</td>
<td>Exams</td>
<td>Activities with questions for you to answer</td>
</tr>
<tr>
<td>Refers you to past exam papers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- We have provided you with a chapter organogram at the beginning of each section to focus your thinking and give you an overview of each section.
- The study guide includes a table of key concepts with definitions which need to be learnt off by heart. You can gain easy marks for the recall of definitions in the single mark questions.
- A checklist from the exam guidelines for Geography has been provided on pages xiv to xvii for you to keep track of your progress. Once you have mastered the core concepts and have confidence in your answers to the questions provided, tick the last column of the checklist.
- The activities are based on exam-type questions. Cover the answers and do the activity on your own. Then check your answers. Reward yourself for the things you get right. If you get any incorrect answers, make sure you understand where you went wrong before moving onto the next section.
- Past exam papers are included in the study guide for you to do. Check your answers by looking back at your notes and the exam memoranda. Past exam papers go a long way in preparing you for what to expect and help reduce exam anxiety. Go to www.education.gov.za to download more past exam papers.

Use this study guide as a workbook. Make notes, draw pictures and highlight important concepts.
Top 10 study tips

1. Have all your materials ready before you begin studying – pencils, pens, highlighters, paper, etc.

2. Be positive. Make sure your brain holds on to the information you are learning by reminding yourself how important it is to remember the work and get the marks.

3. Take a walk outside. A change of scenery will stimulate your learning. You’ll be surprised at how much more you take in being outside in the fresh air.

4. Break up your learning sections into manageable parts. Trying to learn too much at one time will only result in a tired, unfocused and anxious brain.

5. Keep your study sessions short but effective and reward yourself with short, constructive breaks.

6. Teach your concepts to anyone who will listen. It might feel strange at first, but it is definitely worth reading your revision notes aloud.

7. Your brain learns well with colours and pictures. Try to use them whenever you can.

8. Be confident with the learning areas you know well and focus your brain energy on the sections that you find more difficult to take in.

9. Repetition is the key to retaining information you have to learn. Keep going, don’t give up.

10. Sleeping at least 8 hours every night, eating properly and drinking plenty of water are all important things you need to do for your brain. Studying for exams is like strenuous exercise, so you must be prepared physically.
## Question words to help you answer questions

It is important to look for the question words (the words that tell you what to do) to correctly understand what the examiner is asking. Use the words in the following table as a guide when answering questions.

<table>
<thead>
<tr>
<th>Question word</th>
<th>What is required of you</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account for</td>
<td>Explain the cause of; explain why; give reasons for</td>
</tr>
<tr>
<td>Analyse</td>
<td>Separate; examine and interpret critically; positives and negatives; pros and cons</td>
</tr>
<tr>
<td>Annotate</td>
<td>To add explanatory notes to a sketch, map or drawing</td>
</tr>
<tr>
<td>Argue</td>
<td>Put forward reasons in support of or against a statement</td>
</tr>
<tr>
<td>Classify</td>
<td>Place things with similar characteristics in the same group; to arrange according to type or sort</td>
</tr>
<tr>
<td>Comment</td>
<td>Give your opinion, based on facts</td>
</tr>
<tr>
<td>Compare</td>
<td>To list both similarities and differences</td>
</tr>
<tr>
<td>Contrast</td>
<td>Stress the differences between things, events or problems</td>
</tr>
<tr>
<td>Define</td>
<td>Give a concise and clear meaning</td>
</tr>
<tr>
<td>Demonstrate</td>
<td>Show or make clear; illustrate or explain; prove by reasoning and evidence (note that you can give examples)</td>
</tr>
<tr>
<td>Describe</td>
<td>List the main characteristics of something; give an account of (note that a diagram or map may be part of a description)</td>
</tr>
<tr>
<td>Discuss</td>
<td>Give the reasons for your statement; present both sides and reaching a conclusion</td>
</tr>
<tr>
<td>Evaluate</td>
<td>Express an opinion, using evidence, of how good/bad, negative/positive, successful/unsuccessful something is</td>
</tr>
<tr>
<td>Explain</td>
<td>Make clear, interpret, and spell out the material you present. Give reasons for differences of opinion or of results</td>
</tr>
<tr>
<td>Give</td>
<td>To state facts without discussions or explanations (note that you may be asked to ‘Give a reason’)</td>
</tr>
<tr>
<td>Identify</td>
<td>Name a feature from the source material</td>
</tr>
<tr>
<td>Interpret</td>
<td>To give an explanation of; to give the meaning of</td>
</tr>
</tbody>
</table>

### Examples of question words

1. **Draw** a longitudinal profile of a river (from source to mouth) and show the upper, middle and lower course.  
   \[1 \times 4 = 4\]

2. **List** two features of the upper course of a river.  
   \[2 \times 2 = 4\]

3. **Describe** a river in its lower course.  
   \[2 \times 2 = 4\]

4. **Describe** one difference between the river channel in the upper course and the lower course.  
   \[2 \times 2 = 4\]

[16]
Study skills to boost your learning

This guide makes use of three study techniques you can use to help you learn the material:

- Mobile notes
- Mnemonics
- Mind maps

Mobile notes

Mobile notes are excellent tools for learning all the key concepts in the study guide. Mobile notes are easy to make and you can take with them with you wherever you go:

1. Fold a blank piece of paper in half. Fold it in half again. Fold it again.
2. Open the paper. It will now be divided into 8 parts.
3. Cut or tear neatly along the folded lines.
4. On one side, write the basic concept.
5. On the other side, write the meaning or the explanation of the basic concept.
6. Use different colours and add pictures to help you remember.
7. Take these mobile notes with you wherever you go and look at them whenever you can.
8. As you learn, place the cards in three different piles:
   - I know this one now!
   - Next...
8. As you learn, place the cards in three different piles:
   - I know well
   - Getting there
   - I need more practice
9. The more you learn them, the better you will remember them.

x Introduction
Mnemonics

A mnemonic code is a useful technique for learning information that is difficult to remember. This is an example of a word mnemonic using the word MAPPING where each letter of the word stands for something else:

M – Make an effort
A – Apply yourself to your studies
P – Practise, practise, practise your mapwork
P – Prepare well for the exams
I – Ignite your passion for Geography
N – Notice your subject around you
G – Go for it – the stars are the limit!

Mnemonics code information and make it easier to remember.

The more creative you are and the more you link your ‘codes’ to familiar things, the more helpful your mnemonics will be.

This guide provides several ideas for using mnemonics. Be sure to make up your own.

Geography brings us all down to Earth!
Mind maps

There are several mind maps included in this guide, summarising some of the sections.

Have a look at the following pictures of a brain cell (neuron) and a mind map:

![Brain cell or neuron](image)

**Figure 1: Brain cell or neuron**

![Mind map rules](image)

**Figure 2: Mind map rules**

**Mind maps** work because they show information that we have to learn in the same way that our brains ‘see’ information.

As you study the mind maps in the guide, add pictures to each of the branches to help you remember the content.

You can make your own mind maps as you finish each section.

**How to make your own mind maps:**

1. Turn your paper sideways so your brain has space to spread out in all directions.
2. Decide on a name for your mind map that summarises the information you are going to put on it.
3. Write the name in the middle and draw a circle or bubble or picture around it.
4. Write only key words on your branches, not whole sentences. Keep it short and simple.
5. Each branch should show a different idea. Use a different colour for each idea. Connect the information that belongs together. This will help build your understanding of the learning areas.
6. Have fun adding pictures wherever you can. It does not matter if you can’t draw well.
**Top 10 exam tips**

1. Make sure you have all the necessary stationery for your exam, i.e. pens, pencils, eraser, protractor, compass, calculator (with new batteries), as well as your ID document and exam admission letter.

2. Arrive on time, at least one hour before the start of the exam.

3. Go to the toilet before entering the exam room. You don’t want to waste valuable time going to the toilet during the exam.

4. Use the 10 minutes reading time to read the instructions carefully. This helps to ‘open’ the information in your brain. Start with the question you think is the easiest to get the flow going. In the mapwork exam, use this time to look carefully at the whole map.

5. Break the questions down to make sure you understand what is being asked. If you don’t answer the question properly you won’t get any marks for it. Look for the key words in the question to know how to answer it. A list of these words is on page ix of this study guide.

6. Try all questions. Each question has some easy marks in it so make sure that you do all the questions in the exam.

7. Never panic, even if the question seems difficult at first. It will be linked with something you have covered. Find the connection.

8. Manage your time properly. Don’t waste time on questions you are unsure of. Move on and come back if time allows.

9. Check weighting – how many marks have been allocated for your answer? Take note of how marks are allocated to the questions in this study guide. Do not give more or less information than is required.

10. Write big and bold and clearly. You will get more marks if the marker can read your answer clearly.

---

*If you can dream it, you can do it.*

_Walt Disney_
# Learner's checklist

Use this checklist to monitor your progress when preparing for the exam. The ticks (✓) tell you which parts of the curriculum are covered in this study guide. The stars (*) tell you to go to textbooks and class notes.

<table>
<thead>
<tr>
<th>Aspect of the curriculum</th>
<th>Covered in study guide</th>
<th>I do not understand</th>
<th>I understand</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLIMATE AND WEATHER</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Global air circulation and resultant weather patterns</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Changes in energy balance</td>
<td>Four pressure belts ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identification on world map, basic pressure ✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship between temperature, air pressure and wind ✓</td>
<td></td>
<td></td>
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<tr>
<td>Pressure gradient and coriolis force ✓</td>
<td></td>
<td></td>
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<tr>
<td>2. Primary air circulation</td>
<td>Movement of air between equator and poles ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal and vertical air movements ✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tricellular arrangement of circulation ✓</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Hadley, Ferrel and Polar Cell</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>3. Secondary air circulation</td>
<td>Tropical easterlies ✓</td>
<td></td>
<td></td>
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<tr>
<td>Westerlies ✓</td>
<td></td>
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<tr>
<td>Polar easterlies ✓</td>
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<tr>
<td>Intertropical convergence zone (ITCZ) ✓</td>
<td></td>
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<tr>
<td>Monsoon ✓</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4. Tertiary air circulation</td>
<td>Land and sea breezes ✓</td>
<td></td>
<td></td>
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<tr>
<td>Mountain and valley breezes ✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land and sea breezes ✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mountain and valley breezes ✓</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Föhn winds (berg winds) ✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Mid-latitude cyclones and resultant weather</td>
<td>Area of formation ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristics ✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associated weather conditions ✓</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Cold front conditions ✓</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Warm front conditions ✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occluded fronts *</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyclone families *</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identification on synoptic charts ✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact on human activities in South Africa *</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Possible precaution *</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

xiv Introduction
<table>
<thead>
<tr>
<th>Aspect of the curriculum</th>
<th>Covered in study guide</th>
<th>I do not understand</th>
<th>I understand</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Tropical cyclones and resultant weather</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area of formation</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Factors causing tropical cyclones</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristics</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stages in formation</td>
<td>*</td>
<td></td>
<td></td>
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<tr>
<td>Associated weather conditions</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identification on synoptic charts</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Impact on human activities</td>
<td>*</td>
<td></td>
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<tr>
<td>Possible precaution</td>
<td>*</td>
<td></td>
<td></td>
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<tr>
<td>Subtropical anticyclones and resultant weather over South Africa</td>
<td></td>
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<tr>
<td>7. Factors determining the weather over South Africa</td>
<td>✓</td>
<td></td>
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<tr>
<td>8. Anticyclonic circulation</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>9. Travelling disturbances</td>
<td>*</td>
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<tr>
<td>Climate at local scale/microclimatology</td>
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<tr>
<td>10. Valley climates</td>
<td></td>
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<td></td>
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<tr>
<td>Slope aspect</td>
<td>✓</td>
<td></td>
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<tr>
<td>Anabatic winds</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Katabatic winds</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Inversions</td>
<td>✓</td>
<td></td>
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<tr>
<td>Frost pockets</td>
<td>✓</td>
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<tr>
<td>Influence on human activities</td>
<td>✓</td>
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<tr>
<td>11. Urban climates</td>
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<tr>
<td>Reasons for differences between rural and urban climates</td>
<td>✓</td>
<td></td>
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<tr>
<td>Heat islands</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Factors causing higher temperature</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Climate hazards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global warming</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Droughts</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Floods</td>
<td>✓</td>
<td></td>
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<tr>
<td>Storm surge</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Climate change</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Interpretation of synoptic charts</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOMORPHOLOGY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluvial processes and structural landforms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluvial processes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Drainage basins</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Discharge of rivers</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. River capture/stream piracy</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspect of the curriculum</td>
<td>Covered in study guide</td>
<td>I do not understand</td>
<td>I understand</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------</td>
<td>---------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>4. River profiles</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Fluvial landforms</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Catchment and river management</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Structural landforms**

| Topography associated with horizontally layered rock | ✓ |
| Topography associated with tilted rock | ✓ |
| Topography associated with massive igneous rock | ✓ |
| Slope elements/forms | ✓ |
| Mass movements and human response | ✓ |

**PEOPLE AND PLACES**

**Settlement**

| Classification | ✓ |

**Rural settlement**

| Classification and function | ✓ |
| Human-environment interactions | ✓ |
| Sustainability-related strategies | ✓ |

**Urban settlement**

| Classification of urban settlements | ✓ |
| Urban hierarchies | ✓ |
| Urbanisation | ✓ |
| Structures and patterns of urban settlements | ✓ |
| Human–environment interactions: Agenda 21 | ✓ |
| Sustainability-related strategies | ✓ |

**PEOPLE AND THEIR NEEDS**

**Economic geography**

<p>| Economic activities | Primary, secondary, tertiary and quaternary | ✓ |
| Agriculture as an economic activity | ✓ |</p>
<table>
<thead>
<tr>
<th>Aspect of the curriculum</th>
<th>Covered in study guide</th>
<th>I do not understand</th>
<th>I understand</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Industry as an economic activity</td>
<td>Ubiquitous industries</td>
<td>✓</td>
<td>*</td>
</tr>
<tr>
<td>4. Human–environment interactions</td>
<td>SDI's</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IDZ's</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>5. Transport and trade</td>
<td>Balance of trade</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exports and imports</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Balance of payments</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Role of transport</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>6. Informal sector</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>7. Globalisation</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

**Food security**

| 8. Food security and insecurity | | ✓ | | |

| 9. Water as a critical resource | Water schemes | ✓ | | |

**GEOGRAPHICAL SKILLS AND TECHNIQUES**

| 1. Mapwork techniques | | ✓ | | |
| 2. Application | | ✓ | | |

**Photographs**

| 3. Photographs used in mapwork | | ✓ | | |
| 4. Application | | ✓ | | |
| Map projections | | * | | |
| 5. GIS | Concepts | ✓ | | |
This chapter covers global air circulation and changing weather patterns. This knowledge will enable you to analyse weather patterns and the microclimate of cities and valleys in the exam.
## Key concepts

If you know and understand the definitions in this chapter, you will be able to answer most of the questions in the climate and weather (climatology) section of the final exam. Use your mobile notes to learn these concepts well (see page x for instructions on how to make them). Adding pictures to your mobile notes will help you remember the concepts.

<table>
<thead>
<tr>
<th>CONCEPT</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anabatic winds</td>
<td>Warm winds that blow up a valley slope during the day</td>
</tr>
<tr>
<td>Anticyclone (high pressure)</td>
<td>Forms as a result of sinking air. Air movement is anticlockwise, divergent (outwards), subsiding (sinking) in the southern hemisphere, e.g. South Atlantic High, South Indian High and Kalahari High.</td>
</tr>
<tr>
<td>Aspect</td>
<td>The direction in which a slope faces</td>
</tr>
<tr>
<td>Berg winds</td>
<td>Hot, dry winds that blow from the interior of South Africa to coastal areas</td>
</tr>
<tr>
<td>Climate change</td>
<td>Long-term changes to the global climate, resulting in unusual and extreme (stronger) weather conditions</td>
</tr>
<tr>
<td>Coriolis force</td>
<td>A force which changes the direction in which wind blows. It results from the rotation of the Earth.</td>
</tr>
<tr>
<td>Cyclone (low pressure)</td>
<td>Forms as a result of rising air. Air movement is clockwise, convergent (inwards), rising (convection) in the southern hemisphere, e.g. coastal low, tropical cyclone, mid-latitude cyclone.</td>
</tr>
<tr>
<td>Ferrel cell (mid-latitude)</td>
<td>A circulation which occurs between 60° and 30° North and South. Found between the Hadley and Polar cells</td>
</tr>
<tr>
<td>Fohn wind</td>
<td>A warm, dry mountain wind which originates in the Alps</td>
</tr>
<tr>
<td>Global warming</td>
<td>The Earth experiencing higher than normal temperatures</td>
</tr>
<tr>
<td>Hadley cell (tropical)</td>
<td>A circulation which occurs between 0° and 30° North and South. Forms as a result of high temperatures at the equator, forcing air to rise</td>
</tr>
<tr>
<td>Heat island</td>
<td>Higher temperatures in urban areas than the surrounding rural area caused by a pollution dome</td>
</tr>
<tr>
<td>Inter-tropical convergence zone (ITCZ)</td>
<td>An area along the equator where the tropical easterlies from both hemispheres meet</td>
</tr>
<tr>
<td>Inversion layer/thermal belt</td>
<td>Zone of warmer temperature above the valley floor</td>
</tr>
<tr>
<td>Katabatic winds</td>
<td>Cold winds that blow down a valley slope at night</td>
</tr>
<tr>
<td>Land breeze</td>
<td>Occurs at night and blows from the land to the sea</td>
</tr>
<tr>
<td>Monsoons</td>
<td>Seasonal winds that bring heavy rains in summer and drought in winter</td>
</tr>
<tr>
<td>Polar cell</td>
<td>A circulation which occurs between 90° and 60° North and South. This cell forms at the poles as a result of low temperatures causing air to sink</td>
</tr>
<tr>
<td>Polar easterlies</td>
<td>Winds that blow from the polar high pressure belts towards the subpolar low pressure belts (60° to 90°)</td>
</tr>
<tr>
<td>Pressure gradient force</td>
<td>The force that makes air move from a high pressure area to a low pressure area. It determines the speed at which air moves.</td>
</tr>
<tr>
<td>Sea breeze</td>
<td>Occurs during the day and blows from the sea to the land (it has a cooling effect)</td>
</tr>
<tr>
<td>Temperature inversion</td>
<td>Temperature increasing with height</td>
</tr>
<tr>
<td>Tornado/twister</td>
<td>Small, funnel-shaped, violent storm with very strong winds. Has very low pressure in the centre</td>
</tr>
<tr>
<td>Tropical easterlies/trade winds</td>
<td>Winds that blow from the subtropical high belts towards the equatorial low pressure belt (0° to 30°)</td>
</tr>
<tr>
<td>Westerlies</td>
<td>Winds that blow from the subtropical high pressure belts to the subpolar low pressure belts (30° to 60°)</td>
</tr>
</tbody>
</table>
1.1 Primary or global air circulation

Primary or global air circulation covers the whole Earth.

Global air circulation on the Earth’s surface is caused by temperature and pressure differences. It is important to understand how global circulation takes place:

- As air is heated, it becomes less dense (lighter) and rises. This rising air causes a low pressure.
- As air cools, it becomes dense (heavy) and sinks. This sinking air causes a high pressure.
- This **rising and sinking air** caused by different temperatures causes the global air circulation.

The global air circulation is made up of three parts:

1. Tri-cellular circulation
2. Pressure belts
3. Planetary winds

Each of these parts will be explained below.

1.1.1 Tri-cellular arrangement

The tri-cellular arrangement consists of three cells of air circulation, namely the Hadley, Polar and Ferrel cells.

- The **Hadley cell** forms in the equatorial region because of high temperatures at the Equator. We say that it is thermally driven because ‘thermal’ means ‘relating to heat’.
- The **Polar cell** forms in the polar region because of the low temperatures in the North and South Poles.
- Due to the air movements in the Hadley and Polar cells, which cause friction, the third **Ferrel cell** is formed.

Figure 1.1 shows the tri-cellular arrangement.

1.1.2 Pressure belts

There are four pressure belts on the Earth’s surface:

- Two are low pressure belts formed by **rising air**.
- Two are high pressure belts formed by **sinking air**.

Air moves out of the high pressure belts and air moves into low pressure belts, resulting in global winds.

Figure 1.2 on page 4 shows the relationship between air movements (rising and sinking) and the pressures they cause.
The names of the four pressure belts are:

- **Equatorial** low pressure belt
- **Subtropical** high pressure belt
- **Subpolar** low pressure belt
- **Polar** high pressure belt

They are shown in Figure 1.3 below.
### 1.1.3 Global winds/planetary winds

These are winds that cover large areas over the Earth’s surface. There are **three global wind systems:**
- The tropical easterlies
- The westerlies
- The polar easterlies

A force called **Coriolis force** causes global winds to move to the left in the southern hemisphere and to the right in the northern hemisphere.

The tri-cellular arrangement, the pressure belts and the global winds together form the **global air circulation.** This is shown in Figure 1.4 below.

![Figure 1.4: Global air circulation](image)

**Activity 1**

Figure 1.5 (right) shows the tri-cellular arrangement. Study the diagram and answer the questions that follow.

1. Name the cell labelled A. \(1 \times 2 = 2\)
2. State why the air is rising at B. \(1 \times 2 = 2\)
3. Name the winds that blow into area B. \(1 \times 2 = 2\)
4. Describe the pressure experienced in area C. \(1 \times 2 = 2\) \([8]\)

![Figure 1.5: Tri-cellular arrangement](image)
Answers to activity 1

1. Hadley cell ✓ ✓ (2)
2. Air is heated, becomes lighter and rises at the equator ✓ ✓ (2)
3. Tropical easterlies ✓ / trade winds ✓ (2)
4. High pressure ✓ ✓ (2)

1.2 Secondary air circulation

Secondary air circulation affects a particular region or wind belt. Our focus will be on the South African climate, mid-latitude cyclones and tropical cyclones. But first we need to understand synoptic weather maps.

1.2.1 Synoptic weather map interpretation

To better understand weather patterns and weather phenomena you need to be able to interpret the synoptic weather map. A synoptic weather map shows weather conditions and phenomena (temperature, precipitation, wind speed and direction, atmospheric pressure and cloud coverage) over a wide area at a given time based on worldwide observations recorded at the same time (from weather stations, airplanes, weather balloons and satellites).

On a synoptic weather map there are lines called isobars:

- These lines join points of equal pressure (all along one isobar the pressure is the same).
- The pressure is measured in hectopascals (hpa).
- The isobars form patterns (shapes formed by many isobars).

Figure 1.6 shows a low pressure and a high pressure cell.

Figure 1.6A: Low pressure cell as seen on a synoptic weather chart
Figure 1.6B: High pressure cell as seen on a synoptic weather chart

Note that the pressure reading decreases towards the centre of a Low and increases towards the centre of a High.

Figure 1.7 on page 7 shows a simple weather station. It describes the weather of a particular place that is found on a synoptic weather map.

In the exam, you may be asked to describe the weather of a particular place on the synoptic weather map by referring to the weather station. You will need to comment on the following weather elements:

- Cloud cover
- Wind direction
- Wind speed
• Air temperature
• Dew point temperature
• Precipitation (any form of water falling from the sky, e.g. rain, hail, snow and ice)

Note the following weather conditions for this weather station:

<table>
<thead>
<tr>
<th>Weather Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind speed</td>
<td>15 knots</td>
</tr>
<tr>
<td>Wind direction</td>
<td>NW</td>
</tr>
<tr>
<td>Air temperature</td>
<td>27°C</td>
</tr>
<tr>
<td>Precipitation</td>
<td>rain</td>
</tr>
<tr>
<td>Dew point temperature</td>
<td>24°C</td>
</tr>
<tr>
<td>Cloud cover</td>
<td>overcast</td>
</tr>
</tbody>
</table>

**Figure 1.7: An example of a weather station**

<table>
<thead>
<tr>
<th>Cloud Cover</th>
<th>Wind Speed</th>
<th>Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>clear</td>
<td>5 knots</td>
<td>rain, drizzle, showers, snow, hail, fog, mist, thunderstorms, thunderstorms with hail</td>
</tr>
<tr>
<td>¾ cloudy</td>
<td>10 knots</td>
<td></td>
</tr>
<tr>
<td>overcast</td>
<td>15 knots</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 knots</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1.8 Weather symbols used on a synoptic weather chart**

Remember your compass points to determine wind direction.

**NB!** Make sure you know the weather symbols shown in Figure 1.8 (left). They will help you to answer this type of question.

When answering questions based on a synoptic weather chart in the exam, you will be given either a summer synoptic chart (see Figure 1.9 on page 8) or a winter synoptic chart (see Figure 1.10 on page 8). Make sure you know which features to look out for on the chart you are given.

**Summer synoptic chart**

Figure 1.9 on page 8 shows a typical summer synoptic weather chart of South Africa. The features of a summer synoptic chart to note are:

1. Tropical cyclone (look for the symbol on the synoptic chart)
2. Low pressure over the land (see the low pressure cell in Figure 1.9)
3. The date
4. South Indian high pressure found south east of South Africa (see the high pressure cell in Figure 1.9)
5. Generally high temperatures over the land
**Winter synoptic weather chart**

Figure 1.10 below shows a typical winter synoptic weather chart of South Africa. The features of a winter synoptic weather chart to note are:

1. Cold fronts moving over the land
2. Dominant Kalahari high pressure over the land (look for a large high pressure cell over the land)
3. The date
4. South Indian high pressure and the South Atlantic high pressure are closer to the land and further north
5. Generally low temperatures over the land
1.2.2 Factors affecting the South African climate

There are three factors that have the greatest impact on South Africa’s climate:

- South Africa is surrounded by oceans and ocean currents.
- South Africa is mostly found on a plateau.
- South is affected by the subtropical high pressure belt.

These three factors cause the typical weather we experience in each season. Let us look at each factor in more detail.

1.2.2A The impact of the ocean and the ocean currents on South Africa’s climate

Much of South Africa is surrounded by oceans. The oceans affect the temperature at the coast and inland as follows:

- Water heats up slowly and cools down slowly.
- This moderates temperatures along the coastline (i.e. the minimum and maximum temperatures are not very far apart).
- This causes temperatures inland to be extreme (i.e. the minimum and maximum temperatures are very far apart).

For example, in winter the temperature in Johannesburg is a maximum of 25°C and a minimum of 1°C (extreme), whereas in Durban the maximum is 24°C and the minimum is 15°C (moderate).
The **ocean currents** also affect the temperatures and rainfall:

- The currents on our east and west coast have the greatest impact on South Africa’s climate.
- The warm Mozambique current flows along our east coast.
- The cold Benguela current flows along our west coast.
- The warm Mozambique current causes high temperatures and more rain on the east coast.
- The cold Benguela current causes low temperatures and less rain on our west coast.

Because of the influence of these currents, temperatures are higher on the east coast than on the west coast.

Figure 1.11A shows the ocean currents that affect South Africa’s climate and the resultant minimum temperatures.

![Figure 1.11A: The three ocean currents and their effect on minimum temperatures](image)

Figure 1.11B (left) shows the ocean currents that affect South Africa’s climate and the resultant maximum temperatures.

![Figure 1.11B: The three ocean currents and their effect on maximum temperatures](image)

Figure 1.12 on page 11 shows the seasons in which rainfall is received in South Africa. The black arrow shows how rainfall decreases from east to west across the country mainly due to the Mozambique and Benguela currents.

- The east coast gets rain all year round, so it will have a higher rainfall.
- The west coast is an arid (desert) region so it receives very little rain.

To prepare well for the exam and to understand this topic better, find out the cause of the winter rainfall in the south-western Cape.
1.2.2B The impact of the plateau on South Africa’s climate

South Africa is situated mostly on a plateau (a flat area found at a high altitude).

Figure 1.13 below is a cross-section of South Africa from west to east showing the relief (landscape) of the country.

The higher you go, the cooler it gets. Therefore, places on the plateau (high altitude) will experience lower temperatures than places at a lower altitude.

Places in the Lowveld (Mpumalanga) have higher temperatures than places on the Highveld (Gauteng and Free State).
12.2.6 The impact of the subtropical high pressure belt on South Africa’s climate

South Africa is affected by three high pressure cells:
- South Atlantic high pressure (SAHP)
- South Indian high pressure (SIHP)
- Kalahari high pressure (KHP)

Figure 1.14 below shows the position of the three high pressure cells in and around South Africa.

- The South Atlantic high pressure causes cool, dry winds to blow onto the south-western Cape.
- The South Indian high pressure causes warm, moist winds to blow onto the east coast.
- The Kalahari high pressure has the greatest impact on South Africa’s climate:
  - It causes generally clear skies and warm temperatures because the air is descending and dry.
  - It results in only summer rainfall occurring on the plateau.

Figure 1.14: The position of the three high pressure cells in and around South Africa
1.2.3 Characteristics of mid-latitude cyclones and tropical cyclones

Table 1.1 below compares the characteristics of mid-latitude cyclones and tropical cyclones.

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>Mid-latitude cyclone</th>
<th>Tropical cyclone</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Other names</strong></td>
<td>Mid-latitude depression, temperate cyclone, extra tropical cyclone</td>
<td>Hurricane, typhoon, Willie-willies (named alphabetically at the beginning of each season)</td>
</tr>
<tr>
<td><strong>Formation</strong></td>
<td>40–60° N and S ± 5° N and S</td>
<td>± 5° N and S</td>
</tr>
<tr>
<td><strong>Occurrence</strong></td>
<td>30–60° N and S</td>
<td>Over tropical oceans 5–30° N and S</td>
</tr>
<tr>
<td><strong>Movement</strong></td>
<td>West to east</td>
<td>East to west</td>
</tr>
<tr>
<td><strong>Season</strong></td>
<td>All year round in both hemispheres; affects South Africa in winter</td>
<td>Mid- to late summer, early autumn</td>
</tr>
<tr>
<td><strong>Identifying features</strong></td>
<td>Warm front, warm sector, cold front, cold sector</td>
<td>Stormy weather in the vortex; the eye is a calm, intense low pressure area</td>
</tr>
<tr>
<td><strong>Weather</strong></td>
<td>Weather associated with a cold front: overcast, low temperatures, strong winds, heavy rain</td>
<td>Warm to hot, violent winds; intense thunderstorm activity</td>
</tr>
<tr>
<td><strong>Areas affected</strong></td>
<td>Western side of continents in mid-latitudes</td>
<td>Eastern side of continents in tropical latitudes</td>
</tr>
</tbody>
</table>

You must know the characteristics of each cyclone. In the exam these characteristics are typically asked in one of three ways:

1. **Multiple-choice questions**
   Example:
   Another name for a mid-latitude cyclone is:
   1. Temperate cyclone
   2. Tropical storm
   3. Typhoon
   4. Tropical cyclone
   (Correct answer is underlined)

2. **Short answer questions**
   Example:
   List two characteristics of a tropical cyclone.
   Answer:
   1. Forms at 5°N and S
   2. Occurs in late summer, early autumn

3. **Draw a cross-section from A to B**
   For examples, see Figures 1.17 and 1.19.
1.2.4 Mid-latitude cyclones

In this section, we look at **mid-latitude cyclones** in more detail. We will focus on the cross-section through a mature mid-latitude cyclone and the weather that occurs as a result of the cold front. This is the most frequently tested section as South Africa is mostly affected by the passage of cold fronts.

Figure 1.17 below shows a cross-section through a mid-latitude cyclone. You must be able to label and sketch the cross-section from a synoptic view, as shown in Figure 1.15 (see page 13).

As a mid-latitude cyclone moves towards South Africa, it is the **cold front** that mostly affects our weather.

**Weather in front of the cold front** (see point 1 in Figure 1.17 above):
- Cool temperatures
- Very low pressure
- Overcast conditions, cumulonimbus clouds
- Thunderstorms

**Weather behind the cold front** (see point 2 in Figure 1.17 above):
- Cold temperatures
- High pressure
- Partly cloudy conditions, cumulus clouds
- Light rain

Note that as a mid-latitude cyclone moves from west to east, we experience the warm air mass in front of the cold front first, then the air behind the cold front. This can be seen in Figure 1.17 (above) as you move over from point 1 to 2.

Figure 1.18 on page 15 shows the weather conditions before and after the cold front.
1.2.5 Tropical cyclones

A tropical cyclone is a type of low pressure system which generally forms in the tropics. It is accompanied by thunderstorms and a circulation of winds near the Earth’s surface, which is clockwise in the southern hemisphere and counter-clockwise in the northern hemisphere. Tropical cyclones are also known as hurricanes in America; typhoons in China and Japan; and willywillies in Australia. Tropical cyclones are given names alphabetically within the season in which they occurred. For example, ‘Alfred’ will denote that it is the first tropical cyclone to occur in that season.

We will now look at tropical cyclones in more detail by focusing on the cross-section through a mature tropical cyclone.

Figure 1.19 below shows a cross-section through a tropical cyclone. You must be able to label and sketch the cross-section from a synoptic view as shown in Figure 1.16 (see page 14).
Activity 1.2

Study the synoptic weather chart in Figure 1.20 below and answer the questions that follow.

1. Name the high pressure cells labelled A and B. (2 × 2 = 4)
2. Give TWO pieces of evidence from the map that this is a summer map. (2 × 2 = 4)
3. Identify the low pressure cell labelled E. (1 × 2 = 2)
4. The letter G indicates a mid-latitude cyclone.
   a) Name the fronts labelled F and H. (2 × 2 = 4)
   b) In which direction does this cyclone generally move? (1 × 2 = 2)
   c) Describe how front F will affect the weather of Cape Town. (3 × 2 = 6)
5. Refer to the cyclone named Cathy.
   a) What type of cyclone is Cathy? (1 × 2 = 2)
   b) State how many cyclones have occurred for this season, including Cathy. (1 × 2 = 2)
   c) In which direction does this cyclone move? (1 × 2 = 2)
   d) List TWO conditions necessary for this cyclone to form. (2 × 2 = 4)
6. Refer to the weather station labelled D and describe the weather in terms of: cloud cover, wind speed, wind direction, air temperature, dewpoint temperature. (4 × 2 = 8)

Figure 1.20: Synoptic chart
**Answers to activity 1.2**

1. A – South Atlantic high pressure✓✓
   B – South Indian high pressure✓✓ (4)

2. A tropical cyclone can be seen on the map✓✓
   Mid-latitude cyclones are seen south of South Africa✓✓
   The South Indian and South Atlantic high pressures are south of South Africa✓✓
   A low pressure cell can be seen over the centre of South Africa✓✓
   The date: 30/01/2010✓✓ (any 2) (4)

3. Coastal low pressure (2)

4. a) F – Cold front✓✓; H – Warm front✓✓ (4)
   b) In an easterly direction/from west to east✓✓ (2)
   c) Temperatures will decrease✓✓; pressure will increase✓✓;
      Cumulonimbus clouds and thunderstorms will occur✓✓ (6)

5. a) Tropical cyclone✓✓ (2)
   b) Three✓✓ (2)
   c) Westerly/from east to west✓✓ (2)
   d) Temperature must be above 27 °C✓✓; Humidity must be high✓✓; There must be light and variable wind✓✓;
      The atmosphere must be unstable✓✓; There must be a wide area of low pressure with closed isobars✓✓;
      It must be between 5°S and 25°S (needs Coriolis force)✓✓;
      Low surface friction✓✓ (any 2) (4)

6. Cloud cover✓✓: Clear skies✓✓; Wind speed✓✓: 10 knots✓✓;
   Wind direction: SSE✓✓; Air temperature✓✓: 22°C✓✓;
   Dewpoint temperature: 15 °C✓✓ (8)

**1.2.6 Monsoons**

A monsoon is a wind system that reverses direction from summer to winter. It occurs in Asia, central Africa and Australasia.

**Summer monsoon**

It is summer when the winds move from the sea to the land, or when there is a low pressure over the land. This results in heavy rainfall and flooding can occur.

In the exam, you may be asked to identify the season and the weather that occurs with a monsoon.

**Winter monsoon**

It is winter when the winds blow from the land to the sea, or there is a high pressure over the land. This results in dry conditions and droughts can occur.

Figure 1.21 shows the summer and winter monsoons in India.
1.3 Tertiary air circulation

Tertiary circulations occur on a local scale and last for a few hours. In this section we will focus on:
- Anabatic and katabatic winds
- Aspect
- City climates

1.3.1 Anabatic and katabatic winds

The structure of a valley and the heating and cooling that occurs during a day cause anabatic and katabatic winds to occur. This is shown in Figures 1.22A and 1.22B.

Effect of anabatic winds on settlements
- Anabatic winds take pollution out of the valley.

Effects of katabatic winds on settlements
- Katabatic winds trap pollution in the valley.
- Katabatic winds bring cold temperatures to the valley.

Katabatic winds lead to the development of an inversion layer (zone of warmer temperature above the valley floor) and a frost pocket (an area of very cold temperatures at the bottom of a valley where frost occurs) in a valley at night. This is shown in Figure 1.23A on the next page.
At night, cold katabatic winds subside into the valley. Warm air at the bottom of the valley is forced to rise; this forms a temperature inversion halfway up the valley. Cold air collects at the bottom of the valley forming a frost pocket.

**Figure 1.23A: Inversion layer and the development of frost pockets in a valley**

Figure 1.23B below shows the impact of an inversion layer on pollution in a valley.

**Figure 1.23B: The impact of an inversion layer on pollution in a valley**

**Effects of temperature inversions on settlement and farming**
- People will build their houses halfway up the slope of a valley to be in the warmer thermal belt (point A on Figure 1.23A).
- Crops which need warm, frost-free conditions will be planted in the thermal belt, for example sugar cane (point A on Figure 1.23A).

**Effects of frost pockets on settlement and farming**
- Crops which can withstand cold conditions (such as frost) can be planted at the bottom of the valley, for example potatoes (point B on Figure 1.23A).
- Pollution is trapped in the cold air below the temperature inversion at night, as shown in Figure 1.23B.
1.3.2 Aspect

Aspect refers to the direction in which a slope faces. This determines whether the Sun’s rays will hit the side of the valley directly or indirectly (obliquely). We will focus on how aspect influences the temperatures of north- and south-facing slopes in the southern hemisphere.

Let us look at how the Sun’s rays affect slope temperatures in the southern hemisphere:

- North-facing slopes receive the direct rays of the Sun, making them warmer.
- South-facing slopes receive the indirect rays of the Sun, making them cooler.

Figure 1.24 below shows how aspect influences the temperatures of north- and south-facing slopes in the southern hemisphere.

Activity 1.3

Figure 1.25 (left) illustrates valley climates. Study the diagram and answer the questions that follow.

1. Name the valley winds depicted in A and B. \(2 \times 2 = 4\)
2. State ONE advantage of the wind labelled A. \(1 \times 2 = 2\)
3. Name the layer labelled C. \(1 \times 2 = 2\)
4. Explain how the wind labelled B influences:
   a) Farming in the valley \(2 \times 2 = 4\)
   b) Industry in the valley \(2 \times 2 = 4\)
1.3.3 City climates

Urban areas (cities) experience a different climate compared to the surrounding rural areas. This results in the formation of a heat island over the city. In this section, we will focus on the causes of a heat island.

An urban heat island is when the city has warmer temperatures than the surrounding rural areas.

In the exam, you may be asked how the temperatures change as you move towards the centre of the city. Figure 1.26 below shows how the temperatures increase the closer you get to the city centre (also called the Central Business District, or CBD). Note also the lower temperatures over the park.

Figure 1.26: An urban heat island profile
A pollution dome is a layer of pollution over the city trapped within the heat island. This is shown in Figure 1.27 (left).

Table 1.2 below lists the factors that cause higher temperatures in the city.

<table>
<thead>
<tr>
<th>Factors that cause heat island</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artificial (man-made) surfaces</td>
<td>Surfaces like tar absorb more heat.</td>
</tr>
<tr>
<td>Surface area (the sides of the buildings add to the surface area)</td>
<td>With a greater area, more heat is absorbed.</td>
</tr>
<tr>
<td>Pollution</td>
<td>More factories and cars release more pollution, which traps the heat.</td>
</tr>
<tr>
<td>Artificial heat sources (not from the sun, man-made sources)</td>
<td>Factories, cars and air conditioners release heat into the air.</td>
</tr>
</tbody>
</table>

Table 1.2: Factors that cause a heat island

1.4 Climate hazards

Climate hazards are extreme weather phenomena which have a negative impact on humans. We will focus on the three most common climate hazards, namely:
- Global warming
- Flooding
- Droughts

Global warming is the rise in temperature of the Earth’s atmosphere. It is caused when greenhouse gases (carbon dioxide, water vapour, nitrous oxide and methane) trap terrestrial radiation (heat absorbed by the Earth and then released) in the Earth’s atmosphere, which increases the temperature. It also causes ice to melt in icy regions of the world. Large volumes of melted ice (water) then flow down into streams, rivers, lakes and seas, resulting in rising sea and water levels. This causes floods and massive destruction to low-lying coastal towns and cities. Extreme changes in temperature affect the lives and natural habitats of many people, plants and animals. Changing climate may also cause more extreme weather, such as droughts, violent storms and heavy rain.
Figure 1.28 shows how global warming causes the Earth’s temperature to rise.

![Diagram of global warming](image)

**Figure 1.28: Global warming**

Tables 1.3 to 1.5 below list the causes and effects of the three common climate hazards and suggest solutions to the problem. Note that some of the effects of droughts and floods are the same.

<table>
<thead>
<tr>
<th>GLOBAL WARMING</th>
<th>Causes</th>
<th>Effects</th>
<th>Solutions</th>
</tr>
</thead>
</table>
|                | • Increased levels of carbon dioxide in the atmosphere due to burning of fossil fuels like coal, oil and petrol  
• Main sources of atmospheric pollution are factories and cars  
• Methane released from cattle farming | Climate change, which results in:  
• Increased floods and drought  
• More extreme or unusual weather  
• Melting of the ice caps and increase in sea level | • Improve public transport  
• Plant more trees or rooftop gardens  
• Households must recycle  
• Use renewable energy sources  
• Education |

**Table 1.3: Global warming**

<table>
<thead>
<tr>
<th>FLOODING</th>
<th>Causes</th>
<th>Effects</th>
<th>Solutions</th>
</tr>
</thead>
</table>
|          | • Heavy rainfall in a short space of time  
• Soft rainfall over a long period of time  
• Storm surges  
• Tsunamis | People and animals are killed  
• Farm land is destroyed  
• Increased soil erosion  
• Roads and buildings are damaged  
• Decline in the economy | • Make sure people do not build close to rivers  
• Have warning systems, emergency procedures and evacuation plans in place  
• Plant more vegetation on slopes and in urban areas  
• Build stronger houses |

**Table 1.4: Flooding**
**DROUGHTS**

<table>
<thead>
<tr>
<th>Causes</th>
<th>Effects</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolonged period of no rain caused by:</td>
<td>• People and animals die</td>
<td>• Improve ways in which water is stored, e.g. canals, furrows, dams</td>
</tr>
<tr>
<td>• El Nino</td>
<td>• Crops are destroyed</td>
<td>• Make use of water transfer schemes</td>
</tr>
<tr>
<td>• Global warming</td>
<td>• Increase in migration to other areas</td>
<td>• Remove alien plants</td>
</tr>
<tr>
<td></td>
<td>• Decline in the economy</td>
<td></td>
</tr>
</tbody>
</table>

*Table 1.5: Droughts*

**Activity 1.4**

Figure 1.29 (left) is a cartoon based on the impact of global warming. Study the cartoon and answer the questions that follow.

1. Define the term global warming.  
   \[1 \times 2 = 2\] (2)

2. What impact of global warming does the cartoon highlight?  
   \[1 \times 2 = 2\] (2)

   \[2 \times 2 = 4\] (any 2) (4)

*Answers to activity 1.4*

1. Higher than normal temperatures experienced on the Earth’s surface✓✓  
   (2)
2. Flooding✓; melting glaciers✓  
   (2)
3. Plant more trees✓; use alternate sources of energy✓; sustainable farming methods✓  
   (any 2) (4)

*Exams*

For more questions on climate hazards, refer to the following National Geography exam papers:

- Geography Paper 1 November 2010 – Question 2.4.6 on page 8.
- Geography Paper 1 November 2011 – Question 1.4 on page 4.
Geomorphology is the study of the landforms found on the Earth’s surface and the processes that create them. In this chapter, geomorphology is covered in two parts:

• Fluvial geomorphology
• Structural geomorphology

The following table of key concepts covers both fluvial and structural geomorphology.

### Key concepts

<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base flow</td>
<td>The flow of groundwater in the same direction as the river</td>
</tr>
<tr>
<td>Base level</td>
<td>The lowest level to which a river can erode</td>
</tr>
<tr>
<td>Cap rock</td>
<td>A hard layer of rock found on top of a landform</td>
</tr>
<tr>
<td>Condensation</td>
<td>When water vapour reaches dewpoint temperature and changes into water droplets</td>
</tr>
<tr>
<td>Deposition</td>
<td>When a river deposits (lays down) the sediment it is carrying on the river bed</td>
</tr>
<tr>
<td>Drainage basin</td>
<td>An area drained by a river system</td>
</tr>
<tr>
<td>Erosion</td>
<td>The removal of soil and wearing away of rocks by wind, water or ice.</td>
</tr>
<tr>
<td>Evaporation</td>
<td>When water in the liquid form is converted (changed) into water vapour (gas)</td>
</tr>
<tr>
<td>Flow hydrograph</td>
<td>A graph showing river discharge over a period of time</td>
</tr>
<tr>
<td>Groundwater</td>
<td>Water stored below the ground in soil and rock</td>
</tr>
<tr>
<td>Headward erosion</td>
<td>When a river cuts back towards its source</td>
</tr>
<tr>
<td>Igneous rock</td>
<td>Hard rock formed from magma or lava</td>
</tr>
<tr>
<td>Infiltration/percolation</td>
<td>A process whereby water seeps into the soil or rock</td>
</tr>
<tr>
<td>Interception</td>
<td>The process by which raindrops are prevented from falling to the ground by plant leaves, stems and branches</td>
</tr>
</tbody>
</table>

If you know and understand these definitions of fluvial and structural geomorphology, then you will be able to answer most of the questions in the Geomorphology section of the final exam. Use mobile notes to learn these key concepts. They are easy marks!
<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lag time/basin lag</td>
<td>The time between peak rainfall and peak discharge</td>
</tr>
<tr>
<td>Mass movement/mass wasting</td>
<td>The movement of rock and/or soil downslope under the influence of gravity</td>
</tr>
<tr>
<td>Metamorphic rock</td>
<td>Hard rock formed when igneous or sedimentary rock changes</td>
</tr>
<tr>
<td>Peak discharge</td>
<td>The highest flow of water</td>
</tr>
<tr>
<td>Perennial river/permanent river</td>
<td>River that flows throughout the year</td>
</tr>
<tr>
<td>Precipitation</td>
<td>Any form of water falling from the sky (e.g. rain, hail, snow)</td>
</tr>
<tr>
<td>Porous rock</td>
<td>Rock with many spaces, which allow water to seep through</td>
</tr>
<tr>
<td>Rejuvenation</td>
<td>The renewal of erosion activity in a river</td>
</tr>
<tr>
<td>River/channel flow</td>
<td>Water that flows within a river channel</td>
</tr>
<tr>
<td>River discharge</td>
<td>The volume of water that flows past a point in a river in a given time</td>
</tr>
<tr>
<td>River meander</td>
<td>A series of bends in a river as it moves along the floodplain</td>
</tr>
<tr>
<td>River source</td>
<td>This is where a river starts; normally high up in mountainous areas</td>
</tr>
<tr>
<td>River mouth</td>
<td>This is where a river ends; normally when it reaches the sea or ocean</td>
</tr>
<tr>
<td>Runoff/overland flow</td>
<td>Rainwater which runs overland towards a river, lake or the sea</td>
</tr>
<tr>
<td>Scarp recession/retreat</td>
<td>Backward movement of a slope without changing its angle</td>
</tr>
<tr>
<td>Seasonal/periodic / non-perennial river</td>
<td>River that only flows during the rainfall season</td>
</tr>
<tr>
<td>Sedimentary rock</td>
<td>Softer rock formed when sediments are deposited and compressed in layers</td>
</tr>
<tr>
<td>Soil moisture</td>
<td>Water that is stored in the topsoil</td>
</tr>
<tr>
<td>Stream capture/piracy</td>
<td>When one river ‘robs’ another of its water</td>
</tr>
<tr>
<td>Stream channel</td>
<td>Where the water flows in a river (river bed)</td>
</tr>
<tr>
<td>Surface storage</td>
<td>A place where water collects or is collected on the surface</td>
</tr>
<tr>
<td>Throughflow</td>
<td>The movement of groundwater through the soil due to gravity</td>
</tr>
<tr>
<td>Transpiration</td>
<td>Water vapour is released from leaves in trees and plants</td>
</tr>
<tr>
<td>Tributary</td>
<td>A smaller river which flows into (joins) a larger river</td>
</tr>
<tr>
<td>Watershed/Drainage divide</td>
<td>High-lying land separating drainage basins</td>
</tr>
<tr>
<td>Water table</td>
<td>The level below which the ground is saturated (it can hold no more water)</td>
</tr>
</tbody>
</table>
Part A: Fluvial geomorphology

Part A deals with the action of water on the Earth’s surface. The word **fluvial** refers to the action of running water.
2.1 Groundwater

Groundwater is water stored beneath the Earth’s surface. When precipitation (rain) falls to the surface of the Earth, it either flows over the surface (runoff) or it is absorbed (infiltrates) into the groundwater supply. This section studies how the infiltration, runoff and groundwater systems work and lead to the formation of rivers. Refer to Figure 2.1 below of the water cycle (this was studied in Grade 11).

Groundwater supplies are replenished (filled up) when water infiltrates into the ground. For water to infiltrate into the soil, three important aspects should be present:

1. Enough porous soil or rock to allow the water to infiltrate through it.
2. Time for the surface water to be absorbed into the ground. This is affected by the steepness of the slope and the nature of the rain.
3. Vegetation (plants) to slow down the speed of runoff, making it easier for infiltration to happen.
To see how these three aspects affect runoff and infiltration study Table 2.1 below.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Impact on groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porous rock</td>
<td>More infiltration, less runoff and more groundwater</td>
</tr>
<tr>
<td>Rock is not porous</td>
<td>Less infiltration, more runoff and less groundwater</td>
</tr>
<tr>
<td>More time</td>
<td>More infiltration, less runoff and more groundwater</td>
</tr>
<tr>
<td>Less time</td>
<td>Less infiltration, more runoff and less groundwater</td>
</tr>
<tr>
<td>More vegetation</td>
<td>More infiltration, less runoff and more groundwater</td>
</tr>
<tr>
<td>Less vegetation</td>
<td>Less infiltration, more runoff and less groundwater</td>
</tr>
</tbody>
</table>

Table 2.1: Factors affecting runoff and infiltration

Figure 2.2 below shows the impact of rock type, time and vegetation on groundwater. From the diagram we can see how the amount of groundwater affects the height of the water table. This is the level below which the ground is saturated (when it can hold no more water).

Figure 2.2: Factors that affect groundwater and movement of water on the surface

**Activity 2.1**

1. List three important things that should be present for water to infiltrate into the soil. (3 × 2 = 6)
2. Describe how groundwater supplies are replenished (filled up). (1 × 2 = 2)
3. Why is it important to manage (look after) groundwater? [10]
2.2 Rivers

When there is less infiltration, more runoff takes place. This starts as sheet flow but very soon the water flows in a path called channel flow.

When we study rivers we look at them in different ways:
- Types of rivers
- River discharge
- Drainage basins
- Stages and profiles of rivers

2.2.1 Types of rivers

The water table refers to the surface of the water-saturated part of the ground. The height of the water table changes each season. This gives rise to different types of rivers. Rivers are classified depending on when (or if) the river valley cuts into the water table.

There are three types of rivers:
- **Permanent rivers** flow all year round and are always in contact with the water table.
- **Periodic rivers** only flow during the rainy season. They are in contact with the water table only in the rainy season.
- **Episodic rivers** only flow after heavy rainfall when runoff flows into the river. They do not come into contact with the water table.

![Figure 2.3: Cross section of the three different types of rivers](image_url)

In the exam, you may be given a diagram of a cross section of a river and asked to identify the type of river. Learn to identify the different river types by redrawing and labelling Figure 2.3.
2.2.2 River discharge

The amount of water flowing out of a river shows many aspects of a river. One way to study this discharge or runoff is by looking at a flow hydrograph.

When runoff enters a river, the amount of water flowing in the river increases. A hydrograph records how quickly the water level increases (time) and how high the water level reaches (peak flow discharge).

A flow hydrograph combines two graphs:
- A bar graph showing the amount of precipitation
- A line graph showing how the water level increases and decreases over time

Figure 2.4 below shows an example of a flow hydrograph. Study the graph and then read the explanation alongside.

Explanation of the elements in Figure 2.4 (left):
1. The line graph shows the volume of the river over time. The horizontal axis shows time in hours and the vertical axis shows runoff in cubic metres per second (m³/sec).
2. The rising segment shows the rate at which the water in the river is increasing. It is steep if infiltration is rapid. It is gentle if infiltration is slow as water takes longer to reach the river.
   - **Urban areas** have a rapid rising segment as the water reaches the river quickly.
   - **Naturally vegetated areas** allow for infiltration and the rising segment is less steep.
3. The falling segment shows the rate at which the water in the river is decreasing. It may be less steep than the rising segment.
   - In **urban areas** the segment falls rapidly as less water has been added as base flow due to lower infiltration.
   - **Natural areas** show a slower decrease due to added base flow from infiltrated water.
4. The bar graph shows the amount of rainfall (precipitation) that occurs in the drainage basin over time. This is shown on the vertical axis in millimetres (mm).
5. **Time lag** (also called lag time) is the time that it takes from the heaviest rainfall to the fullest amount of water in the river (peak flow). It is calculated by establishing the time difference between the heaviest rainfall and the peak flow of the river.
6. **Base flow** is the groundwater contribution to the discharge of a river.
7. The highest point on the line graph is the **peak flow discharge**. This is when the river reaches its highest volume.
The flow hydrograph in Figure 2.4 (see page 31) can be interpreted as follows:
The slope of the line graph indicates the increase in the river’s volume (discharge). If the slope of the line graph is steep, there is more runoff than infiltration. If the slope is gentle, there is more infiltration than runoff. The graph in Figure 2.4 has a steep slope, so there is more runoff than infiltration.
The highest point on the line graph is the peak flow discharge. This is when the river reaches its highest volume. The difference in time between when it rains and when the peak flow discharge occurs is called the time lag. The time lag is affected by the amount of runoff and infiltration that occurs. More runoff causes a shorter time lag and more infiltration causes a longer time lag.
The following factors influence the time lag:
• Amount of vegetation (increased vegetation reduces runoff and causes a longer time lag)
• Steepness of slope (a steeper slope increases runoff and causes a shorter time lag)
• Amount of rainfall (lots of rainfall increases runoff and causes a shorter time lag)
• Nature of rainfall (heavy rainfall increases runoff and causes a shorter time lag)

Figure 2.5 below shows the difference in the time lag between a natural catchment and an urbanised catchment.

We can interpret the flow hydrograph in Figure 2.5 as follows:
• The line graph for the urbanised catchment area is much steeper than the line graph for the natural catchment as there is more runoff and less infiltration in the urbanised catchment.
• This is because the urbanised catchment has less vegetation which results in more runoff.

<table>
<thead>
<tr>
<th></th>
<th>Natural catchment (more vegetation)</th>
<th>Urbanised catchment (less vegetation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>More infiltration</td>
<td>Less infiltration</td>
<td></td>
</tr>
<tr>
<td>Less runoff</td>
<td>More runoff</td>
<td></td>
</tr>
<tr>
<td>Longer time lag</td>
<td>Shorter time lag</td>
<td></td>
</tr>
<tr>
<td>Lower peak discharge</td>
<td>Higher peak discharge</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2.2: The difference between natural catchment and urbanised catchment**

The amount of runoff on the surface leads to the development of rivers, which together form a river system within a drainage basin.
2.2.3 Drainage basins

A **drainage basin** is an area drained by a river system. You need to know the different parts of a drainage basin to understand the other aspects of rivers, such as a river’s source, river mouth, watershed and tributaries. Figure 2.6 (right) shows the different parts of a drainage basin.

A river does not flow by itself but is part of a river system (a main river and all its tributaries).

We will now look at two aspects of river systems: drainage density and drainage patterns.

### 2.2.3A Drainage density

**Drainage density** describes how many streams there are in a drainage basin. Drainage density is affected by the same factors that affect runoff and infiltration:

- More infiltration will cause fewer rivers to occur, causing a low drainage density.
- More runoff will cause more rivers to occur, causing a high drainage density.

Figure 2.7A (right) shows a low drainage density and Figure 2.7B (right) shows a high drainage density.

**Interpretation of Figure 2.7A:**

Drainage basin A has fewer tributaries so it has a low drainage density. Some reasons for low drainage density are:

- Soft rainfall causing more infiltration
- Gentle slopes causing more infiltration
- Lots of vegetation causing more infiltration
- Very little rain so the ground can still hold more water causing more infiltration

**Interpretation of Figure 2.7B:**

Drainage basin B has more tributaries so it has a high drainage density. Some reasons for high drainage density are:

- Heavy rainfall causing more runoff
- Steep slopes causing more runoff
- Very little vegetation causing more runoff
- Lots of rain so the ground cannot hold any more water causing more runoff

---

**Figure 2.6: The different parts of a drainage basin**

- **Source**
- **Tributaries**
- **Watershed**
- **River mouth**

Learn Figure 2.6 in order to label a similar diagram in an exam question.

You may be asked in an exam to give reasons for an area having a high or low drainage density.

**Figure 2.7: Low drainage density (A) and high drainage density (B)**
Activity 2.2

Refer to drainage basins A and B in Figure 2.8 (right) and the flow hydrograph showing line graphs D and E after a period of rainfall, to answer the following questions.

1. The rivers in drainage basin A flow all year round. What type of river would this be classified as?
   
   (1 × 2 = 2)

2. Graph D in the flow hydrograph shows the runoff of drainage basin A after a period of rain.
   a) Define the term ‘time lag’.  
      
      (1 × 2 = 2)
   b) How would the lag time change if massive deforestation were to occur in drainage basin A where D was recorded?
      
      (1 × 2 = 2)
   c) Justify your answer in question b).
      
      (2 × 2 = 4)
   d) Name another factor which could occur and have the same impact on the time lag as mentioned in question b).
      
      (1 × 2 = 2)

3. a) State the drainage density of drainage basin B.
    
    (1 × 2 = 2)
   b) Describe THREE possible causes for the drainage density found in drainage basin B.
    
    (3 × 2 = 6)

Answers to activity 2.2

1. Permanent river✓✓  
   
   (2)
2. a) The difference in time between when it rains and when the peak flow discharge occurs✓✓  
      
      (2)
   b) Time lag will be shorter✓✓
      
      (2)
   c) There is less vegetation✓✓, so there is more runoff✓✓.  
      
      (4)
   d) Steep slope✓✓/Heavy rainfall✓✓/Lots of rain✓✓ (any 1)/2

3. a) High drainage density✓✓  
    
    (2)
   b) Heavy rainfall causing more runoff✓✓
      Steep slopes causing more runoff✓✓
      Very little vegetation causing more runoff✓✓
      Lots of rain so the ground cannot hold any more water causing more runoff✓✓
      
      (any 3)/6

   [20]
2.2.3B Drainage patterns

In a river system, individual streams flow over the surface in stream channels. These channels will cut into the rock surface where it is easiest to erode the rock. These channels form patterns known as drainage patterns. Figure 2.9 below shows three types of drainage patterns.

<table>
<thead>
<tr>
<th>Drainage Pattern</th>
<th>Description</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Figure 2.9A: Dendritic pattern</strong></td>
<td>Looks like the branches of a tree with tributaries joining the main river at acute angles</td>
<td>Occurs where the underlying rock is of homogenous (equal) resistance, namely either horizontal (flat) sedimentary rock, igneous or metamorphic rock</td>
</tr>
<tr>
<td><strong>Figure 2.9B: Trellis pattern</strong></td>
<td>Parallel streams with short tributaries joining at right angles (90°)</td>
<td>Occurs where the surface rock is of alternate resistance (strong and weak rock), or where sedimentary rock is folded</td>
</tr>
<tr>
<td><strong>Figure 2.9C: Radial pattern</strong></td>
<td>Streams flow outwards from one raised central point (dome or volcano)</td>
<td>Rivers flow downhill and away from the highest central point.</td>
</tr>
</tbody>
</table>

**Activity 2.3**

Identify and briefly describe the drainage patterns in Figure 2.10 below.

\[ (3 \times 4 = 12) \]

\[ [12] \]

![Figure 2.10: Drainage patterns](image)
Answers to activity 2.3

A  **Dendritic**: Looks like the branches of a tree with tributaries joining the main river at acute angles. ✅✅✅ (4)

B  **Trellis**: Parallel streams with short tributaries joining at right angles (90°). ✅✅✅ (4)

C  **Radial**: Streams flow outwards from one raised central point (dome or volcano). ✅✅✅ (4)

[12]

### 2.2.4 Stages of a river

As a river flows from the mountains (source) to the sea (mouth), the amount of erosion and deposition changes. This changes what the river looks like from its source to its mouth:

- **In its upper course**, a river erodes vertically (downwards) creating steep valleys.
- **In the middle course**, lateral erosion and a little bit of deposition occur. The lateral erosion occurs unequally (unevenly) on the sides of the river. This causes the river to start meandering (flowing or bending from side to side).
- **By the time the river reaches its lower course**, the eroded material (sediment) carried by the river begins to be deposited onto the floodplains. A floodplain is a wide, flat area alongside a river.
- **Floodplains are formed by the river eroding laterally (sideways).** In the lower course the meanders may be cut off when the river flows straight, forming an ox-bow (U-shaped) lake.

Figure 2.11 (see page 37) shows the stages of a river in plan view. Figure 2.12 (see page 37) shows the stages of a river in oblique view. Table 2.3 (see page 37) summarises the features of a river at each stage.

You may be asked in an exam to identify the stage of a river from a plan view, an oblique view or a cross section diagram. You may also be asked to draw a river in a plan view or a cross section diagram of a river at a particular stage. To do this, learn the characteristic features of each stage. This is also useful for identifying the stage of a river on a topographic map.
### 2.2.5 River profiles

When we look at a river from the side (profile view) we can study it from two sides:

- **Longitudinal profile**: The profile from the river’s source to its mouth.
- **Cross profile**: The profile from one side of the river valley to the other side, through the river channel.

Figures 2.13 and 2.14 A to C on the next page show the profiles of a river. These figures are drawn as cross–sectional views. A cross section can be drawn as a longitudinal profile and as a cross profile.
**Figure 2.13:** Cross sectional view of a longitudinal profile

**Figure 2.14A:** Cross profile of upper course

**Figure 2.14B:** Cross profile of middle course

**Figure 2.14C:** Cross profile of lower course

**Figure 2.14:** Cross-sectional views of a cross profile at different stages in a river

---

**Activity 2.4**

1. Draw a longitudinal profile of a river (from source to mouth) and show the upper, middle and lower courses. $(1 \times 4 = 4)$

2. List two features of the upper course of a river. $(2 \times 2 = 4)$

3. Describe a river in its lower course. $(2 \times 2 = 4)$

4. Describe one difference between the river channel in the upper course and the lower course. $(2 \times 2 = 4)$

---

**Answers to activity 2.4**

1. Source

2. Steep V-shaped valley ✓✓
   Narrow channel ✓✓
   Interlocking spurs ✓✓
   Waterfalls ✓✓
   Gorges ✓✓

3. Wide flat floodplain ✓✓
   Wide valley ✓✓
   Very wide channel ✓✓
   Ox-bow lakes ✓✓

4. Narrow channel in the upper course ✓✓
   Wide channel in the lower course ✓✓
2.2.6 River capture and rejuvenation

The longitudinal profile of a river has a concave shape. Changes can occur to a river’s longitudinal profile because of two processes:

- **Rejuvenation**: We will focus on the causes of rejuvenation and the changes to the cross profiles of each stage in a river.
- **River capture**: We will focus on the features that occur as a result of river capture.

### 2.2.6A Rejuvenation

When a river gets more energy it is said to be rejuvenated. It has more energy to erode downwards and laterally (sideways).

The causes of river rejuvenation are:

- An increase in the volume of the river, giving the river more energy.
- A drop in sea level due to uplift of land makes the longitudinal profile steeper, giving the river more energy.

Let us now look at the changes in the cross profiles of a river due to rejuvenation:

- **Upper course**: The valley becomes steeper and more V-shaped. This is shown in Figure 2.15B (below right).

  ![Figure 2.15A: An oblique view of a river valley in the upper course before river rejuvenation has occurred](image)

  ![Figure 2.15B: An oblique view of a river valley in the upper course after river rejuvenation has occurred](image)

  ![Figure 2.16: A cross profile of a river valley in the middle course after rejuvenation has occurred](image)

  - **Middle course**: Downward erosion results in a second U-shaped valley forming. This results in a valley within a valley. This is shown in Figure 2.16 (left).

  ![Figure 2.17: A cross profile of a river valley in the lower course after rejuvenation has occurred](image)

- **Lower course**: Downward and lateral (sideways) erosion cause a second valley to form. Because floodplains occur in this stage of a river, the valleys have a step-like (terraced) appearance. This is shown in Figure 2.17 (right). If meanders occur, they will be eroded downwards (incised) forming steep-sided meanders.
Let us now look at the changes in the longitudinal profile of a river due to rejuvenation:

The concave shape of a longitudinal profile is called a graded profile. When rejuvenation occurs, there is a sudden drop in the profile, causing the profile to no longer be concave. The profile is now an ungraded profile. The sudden drop in the profile is called a knickpoint. Rejuvenation can occur more than once along a river’s profile forming knickpoints along the way. Figure 2.18A (left) shows a graded (concave) longitudinal profile of a river before rejuvenation. Figure 2.18B (left) shows an ungraded (not concave) longitudinal profile of a river after rejuvenation.

The river wants to regain its concave profile so it will erode the knickpoints, making them less visible over time.

2.2.6B River capture

A river is rejuvenated when it gets more energy. A river which has more energy can lead to more erosion, especially headward erosion. Headward erosion is when the source of a river erodes backwards towards the watershed. The headward erosion eventually leads to the river capturing the water of another river. River capture is sometimes called river piracy. This is because one river ‘robs’ another river of its water.

Headward erosion occurs because a river has more energy. Reasons for the increased energy are:

- A river flowing over a steeper gradient will flow faster
- A river with a larger volume will flow faster
- A river flowing over less resistant rock will flow faster

In Figures 2.19A and B (see page 41) you can see how river A erodes back (headward erosion) towards river B. River A ‘captures’ extra water from river B. River A is rejuvenated.

Study Figures 2.20A and B (see page 41) of stream capture and note the different features formed as a result of river capture.
Once river capture has occurred, various features are visible in the drainage basin.

**Figure 2.19A: Oblique view of the area before river capture**

**Figure 2.19B: Oblique view of the area after river capture**

**Figure 2.20A: Plan view of the area before river capture**

**Figure 2.20B: Plan view of the area after river capture**

Study Figures 2.20A and B (above) and take note of the different features formed as a result of river capture.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captor river</td>
<td>The energetic stream that cuts back and intercepts (takes) the water of the other river</td>
</tr>
<tr>
<td>Captured river</td>
<td>The river which has its water intercepted (taken) by the captor river</td>
</tr>
<tr>
<td>Misfit stream</td>
<td>The river that has lost its source water as a result of capture. It is also called the beheaded stream.</td>
</tr>
<tr>
<td>Elbow of capture</td>
<td>The point of capture where a change of flow direction occurs</td>
</tr>
<tr>
<td>Wind gap</td>
<td>The area between the elbow of capture and the misfit stream where water stops flowing and dry deposited gravels are exposed</td>
</tr>
<tr>
<td>Waterfall</td>
<td>This may form at the point where the captured river flows into the captor river.</td>
</tr>
</tbody>
</table>

*Table 2.4: Features of river capture*

**Example of a description of river capture**

River capture takes place when the energetic stream (captor stream) cuts back and intercepts (takes) the water from the other river (captured/beheaded river). The captured river turns into a misfit stream and a wind gap forms (where water stops flowing altogether). An elbow of capture is formed at the point of capture. Sometimes a waterfall may be formed at the elbow of capture. The captor stream is rejuvenated.
Activity 2.5

Figure 2.21A (right) shows a plan view of an area before river capture has occurred.

Redraw the rivers after river capture has occurred.

On the diagram you have drawn, label the resultant features of river capture.

Answer to activity 2.5

Captured river

Elbow of capture

Captor river

Wind gap

Waterfall

Misfit stream

Exams

For more questions on fluvial geomorphology, refer to these national Geography exam papers:

- Geography Paper 1 November 2010 – Question 1.6 on page 5.
- Geography Paper 1 November 2010 – Question 2.6 on page 8.
- Geography Paper 1 February/March 2011 – Question 2.6.3 and 2.6.4 on page 7.
- Geography Paper 1 February/March 2011 – Question 2.6.6 on page 7.
- Geography Paper 1 November 2011 – Question 1.4.3 on page 4.
- Geography Paper 1 November 2011 – Question 1.5.6 on page 4.
- Geography Paper 1 November 2011 – Question 2.5 on page 7.
Part B: Structural geomorphology

Part B looks at how the underlying rock affects the formation of landforms on the Earth’s surface.

- Inclined strata (2.4)
  - Cuesta, homoclinal and hogsback ridges
  - Scarp and dip slope
- Horizontal strata (2.3)
  - Mesa
  - Butte
  - Slope elements (2.7)
- Massive igneous formations (2.5)
  - Tor
  - Dome
- Mass wasting (2.6)

Refer to the list of key concepts at the start of this chapter for the definitions of structural geomorphology. You must know these to be able to answer the questions in the Geomorphology section of the final exam.
In this section we will focus on three main underlying rock structures:

- **Horizontal strata** (layers)
- **Inclined strata** (layers)
- **Massive igneous intrusions**

Table 2.5 below shows the different landscapes that the different rock structures give rise to on the Earth’s surface. These landscapes will be discussed under sections 2.3, 2.4 and 2.5.

<table>
<thead>
<tr>
<th>Horizontal strata (layers) (see section 2.3)</th>
<th>Inclined strata (layers) (see section 2.4)</th>
<th>Massive igneous rocks (see section 2.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plateaux</td>
<td>Cuesta ridges</td>
<td>Batholith</td>
</tr>
<tr>
<td>Canyons</td>
<td>Homoclinal ridges</td>
<td>Laccolith</td>
</tr>
<tr>
<td>Mesas</td>
<td>Hogsback ridges</td>
<td>Lopolith</td>
</tr>
<tr>
<td>Buttes</td>
<td></td>
<td>Sill</td>
</tr>
<tr>
<td>Pointed buttes</td>
<td></td>
<td>Dyke</td>
</tr>
<tr>
<td>Conical hills</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 2.5: Landscape features resulting from underlying rock structures*

### 2.3 Horizontal strata

#### 2.3.1 How horizontal strata are formed

Horizontal strata are formed in two ways:

- When sediments are deposited (laid down) by rivers on floodplains and they harden to form horizontal layers of sedimentary rock.
- When lava flows out on the surface of the Earth in layers, forming hard igneous rock. It is this hard rock (cap rock) that gives rise to landscapes characteristic of horizontal strata.

#### 2.3.2 Formation of landscapes characteristic of horizontal strata

- The hard cap rock is not easily eroded.
- Rivers erode steep valleys (canyons) in weak points in the cap rock. The valleys are separated by wide plateaus (high-lying flat areas).
- The landform is eroded from the side in a process called scarp recession. This is when the softer rock layers under the cap rock are eroded from the sides of the plateau and the plateau becomes narrower. A mesa and then a butte are formed.
- The butte may be further eroded to form a pointed butte.
- These landforms remain at the same height because of their hard cap rock on top.
- This cap rock can be eroded away completely to form a conical hill.
- Features such as mesas and buttes are common in arid (low rainfall) regions like the Karoo.
Figure 2.22 below shows the characteristic landscape found in areas with horizontal strata. This type of landscape typically occurs in the Karoo (Eastern and Western Cape).

A mesa is a flat-topped mountain capped with a hard layer of rock. Mesas are wider than they are high. Figure 2.23A to C shows you different ways of illustrating a mesa.
A butte is a small, flat-topped hill capped with a hard layer of rock. Buttes are narrower than they are high. Figures 2.24 A to C show you different ways of illustrating a butte.

2.3.3 Usefulness of landscapes caused by horizontal strata

- Landscapes with canyons and plateaus are often tourist attractions.
- The slopes of mesas and buttes are too steep to build or farm on.
- The flat land between the mesas and buttes is suitable for roads and farming. However, because they are usually found in dry areas there is not enough water for farming.

2.4 Inclined strata

2.4.1 How inclined strata are formed

Inclined strata are formed when horizontal layers of rock can be tilted (bent) by movements in the Earth’s crust.

2.4.2 Formation of landscapes characteristic of inclined strata

- When horizontal strata made up of hard and soft rock are bent, they cause ridges to form.
- This occurs because the soft rock, under the hard rock, is easily eroded, forming a steep slope.
- The hard rock is not easily eroded, forming a gentle slope.
- So the ridge has a steep scarp slope and a gentle dip slope. This gives the ridge an asymmetrical (uneven) appearance.

Figures 2.25 A to C (page 47) show you different ways of illustrating an inclined ridge.
The ridges formed by inclined strata are classified according to the angle they are tilted at.

There are three types of ridges:
- Cuesta ridges
- Homoclinal ridges
- Hogsback ridges

Study Figure 2.26 below to see the three types of ridges.

<table>
<thead>
<tr>
<th>Cuesta ridge</th>
<th>Homoclinal ridge</th>
<th>Hogsback ridge</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Cuesta ridge" /></td>
<td><img src="image2" alt="Homoclinal ridge" /></td>
<td><img src="image3" alt="Hogsback ridge" /></td>
</tr>
<tr>
<td>Is at an angle of about 5°</td>
<td>Is at an angle of about 10–30°</td>
<td>Is at an angle of about 45°</td>
</tr>
</tbody>
</table>

**Figure 2.26: Three types of ridges**

You may be asked in an exam to identify the three types of ridges. Study Figure 2.26 to help you answer this question.

### 2.4.3 Usefulness of landscapes caused by inclined strata

- The scarp slope is too steep to build or farm on.
- The dip slopes are gentle and can be developed.
- The flat land between ridges is ideal for farming and development of roads and other services.
2.5 Massive igneous intrusions

2.5.1 How massive igneous intrusions are formed

Massive igneous intrusions refer to rock which forms when volcanic rock (molten rock) underneath the Earth’s surface cools and hardens underground (intrusive) to form igneous rocks. These large masses of rock have no layers so we call them massive.

Examples of igneous rocks include granite, dolerite and basalt.

The intruding volcanic rock forms different shapes under the Earth’s surface. Look at Figure 2.27 below to see the different shapes of these intrusions (numbered 1 to 5).

1. Batholith
2. Laccolith
3. Loppolith
4. Sill
5. Dyke

Figure 2.27: Different massive igneous intrusions

2.5.2 Landforms which result from massive igneous rocks

As the soil and rock above the massive igneous intrusion is eroded away, the hard igneous rock is exposed at the surface (you can see it because it is visible). The softer rock around it erodes faster resulting in various landforms. We will focus on two landforms: domes and tors.
2.5.2A Domes

A dome is a large mass of solid rock which sticks out of the ground, above the surrounding landscape. Domes form when:

- Rock and soil above a batholith or laccolith is eroded.
- The softer rock surrounding the batholith or laccolith is also eroded.
- A dome is left sticking out above the ground.

Figures 2.28A and B below show two ways of illustrating a dome.

Figures 2.28A: Photograph of a dome

Figures 2.28B: Cross section through a dome

You may be asked in an exam to identify a dome and state what type of rock caused it to form. Learn Figure 2.28 and the information above to help you answer this question.

2.5.2B Tors

A tor appears as a pile of rounded rock (core stones) placed one on top of another. Tors form when:

- A laccolith or batholith is weathered and eroded underground.
- Chemical weathering occurs in the joints (right-angled cracks) in the rock.
- The overlying layers are removed by erosion.
- Further weathering and erosion occur, leaving a tor.

Figures 2.29A and B below show two ways of illustrating a tor.

Figures 2.29A: Photograph of a tor

Figures 2.29B: Cross section of a tor

You may be asked in an exam to identify a tor and briefly describe how it forms. Learn Figure 2.29 and this information alongside to help you answer this question.
Activity 2.6

1. Name three main underlying rock structures. \( (3 \times 2 = 6) \)
2. List two characteristics of each of the following landforms:
   a) Mesa \( (2 \times 2 = 4) \)
   b) Butte \( (2 \times 2 = 4) \)
3. Describe two uses of the dip slope by people. \( (2 \times 2 = 4) \)
4. Name two features associated with batholiths that are visible on the Earth’s surface. \( (2 \times 2 = 4) \)

Answers to activity 2.6

1. Horizontal strata ✓ ✓, inclined strata ✓ ✓, massive igneous rock ✓ ✓ \( (6) \)
2. a) Flat-topped ✓ ✓, has resistant cap rock ✓ ✓, wider than it is high ✓ ✓ \( (any \ 2)(4) \)
   b) Flat-topped ✓ ✓, has resistant cap rock ✓ ✓, higher than it is wide ✓ ✓ \( (any \ 2)(4) \)
3. Flat so easier to farm on ✓ ✓, easier to build roads on ✓ ✓ \( (4) \)
4. Dome ✓ ✓ and tor ✓ ✓ \( (4) \)

Now that you have studied the section on structural geomorphology, try the following activity.
2.6 Mass wasting

Once rock and soil have been weathered and eroded, they move downwards. Mass wasting is also known as mass movement. It refers to the movement of rock and soil down a slope under the influence of gravity. We will focus on four types of mass wasting:

- Soil creep
- Earth and mud flows
- Landslides
- Rock falls

Table 2.6 below and Figures 2.30A to D (below right) show the four different types of mass wasting, their causes and impacts.

<table>
<thead>
<tr>
<th>Soil creep</th>
<th>Definition</th>
<th>Causes</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The slow movement of soil down a slope.</td>
<td>Gravity causes soil to move slowly down a slope. Human undercutting of slopes for roads, buildings, etc. can increase the occurrence of soil creep.</td>
<td>Walls crumble, telephone poles snap, buildings become unstable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Earth flow and mud flow</th>
<th>Definition</th>
<th>Causes</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>An earth flow is when saturated soil cannot hold any more water, and soil and rocks move quickly down a slope. A mud flow is when saturated soil (cannot hold any more water) moves quickly down a slope.</td>
<td>When soils become saturated during heavy rainfall or when ice in the soil melts, earth and mud flows can occur.</td>
<td>Both of these mass movements can cause serious damage to settlements, infrastructure and loss of life.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Landslide</th>
<th>Definition</th>
<th>Causes</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sudden and violent movement of ground down a slope</td>
<td>Earthquakes, undercut slopes, steep mountain passes and saturated soils can all cause these sudden movements. Poor construction and removal of vegetation can also contribute to these slides.</td>
<td>Can cause serious damage to settlements, infrastructure and loss of life</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rock fall</th>
<th>Definition</th>
<th>Causes</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sudden and violent movement of rocks down a slope</td>
<td>Earthquakes, undercut slopes, mountain passes and saturated soils can all cause these sudden movements. Poor construction, removal of vegetation and failure to manage slopes properly can all contribute to these falls.</td>
<td>Can cause serious damage to settlements, infrastructure and loss of life</td>
</tr>
</tbody>
</table>

Table 2.6: Four types of mass wasting
The following solutions can be implemented to prevent mass wasting:

- Construct concrete walls at steep road cuttings.
- Plant vegetation to prevent erosion.
- Remove loose rocks that could fall down.
- Do not build settlements on steep slopes.
- Manage water flow on the slopes (e.g. canals, furrows and pipes).
- Use mesh wiring to create barriers.

In an exam you may be asked to identify the type of mass wasting in a diagram, and state its causes or impacts. You also need to learn the solutions that prevent mass wasting. Learn Table 2.6 and Figures 2.30A to D (see page 51) and the information on this page to answer this question.
2.7 Four slope elements

When we look at landscapes caused by horizontal strata, we note particular shapes or patterns on the sides or slopes of the mountain. There are four slope elements:

- Crest
- Free face or cliff
- Talus
- Pediment

Each of these slope elements have specific characteristics which are shown in Figure 2.31 (below).

A. Crest: Convex shape where weathered material falls over the cliff, soil creep occurs

B. Free face/cliff: Bare rock, vertical, formed when cap rock collapses due to scarp recession, rock falls occur

C. Talus slope: Boulders and stones from collapsed cliff collect here, constant angle of 35° to 37°, finer materials washed out into pediment

D. Pediment slope: Gentle slope, covered with fine sediment from talus slope, useful for human activity

Figure 2.31: The four slope elements

Figure 2.32: Cross section of the four slope elements

You may be asked to draw a cross section to show the four slope elements and label them as shown in Figure 2.32.
Activity 2.7

Use the topographical map of Nelspruit 2530BD at the back of this study guide to answer the following questions.

1. The contour interval of this topographical map is...
   A. 1000 metres
   B. 50 000 metres
   C. 25 metres
   D. 20 metres

2. The Crocodile River is a/an...
   A. Periodic river
   B. Exotic river
   C. Permanent river
   D. Seasonal river

3. The type of slope in block B2 can be described as...
   A. Steep
   B. Gentle
   C. Cliff
   D. Free face

4. Nelspruit and its surrounding area is generally a...
   A. Dry area
   B. Wet area
   C. Flat area
   D. Desert area

5. The shape of the Crocodile River as it moves through Nelspruit is...
   A. Meander
   B. Radial
   C. Trellis
   D. Dendritic

(5 × 2 = 10)

Answers to activity 2.7

1. D ✓✓
2. C ✓✓
3. B ✓✓
4. B ✓✓
5. A ✓✓
For more questions on structural landforms, refer to these National Geography exam papers:

- Geography Paper 1 November 2010 – Question 1.5 on page 5.
- Geography Paper 1 February/March 2011 – Question 2.5 on page 7.
- Geography Paper 1 November 2011 – Question 1.6 on page 5.
- Geography Paper 1 November 2011 – Question 2.6 on page 7.
- Geography Paper 1 November 2011 – Question 2.7.2 on page 7.
- Geography Paper 1 February/March 2012 – Question 2.6.1–2.6.3 on page 7.
Settlement geography is the study of where people live and the reasons why they live where they do.
## Key concepts

<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
</tr>
</thead>
</table>
| Agenda 21 (local)            | A plan of action or process to ensure sustainable development by:  
• Including local communities in all decisions made  
• Using local resources wisely  
• Including indigenous knowledge  
• Developing the local community and improving the quality of life of people alongside conservation strategies |
<p>| Break-of-bulk town/city      | Where one type of transport is replaced by another type, e.g. a harbour or port                                                                                                                         |
| Central place town/city      | Provides urban services to surrounding rural area                                                                                                                                                    |
| Dispersed pattern/isolated pattern | Buildings are arranged far apart from one another                                                                                                  |
| Dormitory town/city          | A settlement which is mostly residential, as people work in a nearby city                                                                          |
| Dry-point settlement         | A settlement in a wet area which could be flooded and so is situated away from the water source                                                 |
| Function                     | Refers to the activities (primary, secondary or tertiary) that take place in settlements                                                        |
| Gap town/city                | A town or city situated at a point of access over or through a physical barrier, e.g. at a mountain pass                                               |
| Hierarchy                    | Ranking of places from villages to megalopolis OR ranking of functions or orders within an urban centre                                             |
| Informal settlement          | An informal or unplanned area that is occupied by people who do not have access to formal housing and who erect dwellings on open land, usually on the outskirts of a town. Buildings are made of cardboard, zinc, plastic or wood, or any available materials. It is also sometimes called a squatter camp or shanty town |
| Junction town/city           | Where two major transport routes meet. This can be roads or railway lines.                                                                           |
| Land use zones               | Areas in an urban area that have a specific purpose or function                                                                                    |
| Minimum service area         | The minimum area needed to maintain a settlement, service or function                                                                              |
| Multifunctional              | This is classified as urban because it has both secondary and tertiary activities                                                                  |
| Nucleated pattern/clusters pattern | Buildings are arranged close to one another                                                                                                     |
| Pull factors (positive factors) | The qualities of an area that make people want to move there                                                                                     |
| Push factors (negative factors) | Problems experienced in an area that make people move away                                                                                       |
| Range                        | The maximum distance people are prepared to travel to a settlement or a function                                                                     |
| Rate of urbanisation         | The speed at which urbanisation is taking place                                                                                                   |
| Rural depopulation           | A decrease in the number of people living in rural areas as the population ages because young people are leaving                                      |
| Rural–urban migration        | People move from the rural areas in search of better opportunities in cities                                                                       |</p>
<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settlement</td>
<td>A group of people living on a day-to-day basis in an area that has buildings, communication networks and functions</td>
</tr>
<tr>
<td>Settlement pattern</td>
<td>This refers to a settlement being arranged either in a nucleated or dispersed manner</td>
</tr>
<tr>
<td>Site</td>
<td>The actual piece of land that a settlement is found on</td>
</tr>
<tr>
<td>Situation</td>
<td>The settlement in relation to its surrounding environment</td>
</tr>
<tr>
<td>Specialised town/city</td>
<td>A town or city with one main dominant function</td>
</tr>
<tr>
<td>Sphere of influence</td>
<td>The maximum area served by a settlement or function</td>
</tr>
<tr>
<td>Threshold population</td>
<td>The minimum number of people needed to maintain a settlement or function or to keep it profitable</td>
</tr>
<tr>
<td>Trade and transport town/city</td>
<td>Town or city found near to or on transport routes</td>
</tr>
<tr>
<td>Types of towns/cities</td>
<td>There are three main types of towns/cities:</td>
</tr>
<tr>
<td></td>
<td>• Central place towns/cities</td>
</tr>
<tr>
<td></td>
<td>• Trade and transport towns/cities</td>
</tr>
<tr>
<td></td>
<td>– Break-of-bulk towns/cities</td>
</tr>
<tr>
<td></td>
<td>– Junction towns/cities</td>
</tr>
<tr>
<td></td>
<td>– Gap towns/cities</td>
</tr>
<tr>
<td></td>
<td>• Specialised towns/cities</td>
</tr>
<tr>
<td>Types of settlements</td>
<td>These are classified as either rural or urban according to function</td>
</tr>
<tr>
<td>Unifunctional</td>
<td>This is classified as rural because it has mainly primary activities</td>
</tr>
<tr>
<td>Urban expansion</td>
<td>The area that an urban area uses (physical area) increases over time, e.g. new buildings and infrastructure</td>
</tr>
<tr>
<td>Urban growth</td>
<td>The number of people living in an urban area increases by natural increase (births minus deaths) as well as rural–urban migration</td>
</tr>
<tr>
<td>Urban profile</td>
<td>The view of an urban area from the side to indicate the different land use zones</td>
</tr>
<tr>
<td>Urbanisation</td>
<td>The increasing number of people living in urban areas</td>
</tr>
<tr>
<td>Village shapes</td>
<td>Rural villages are classified as linear, round/square or crossroads</td>
</tr>
<tr>
<td>Wet-point settlement</td>
<td>A settlement in a dry area situated near to a water source</td>
</tr>
</tbody>
</table>

### 3.1 Classification of settlements

Settlements are classified according to function, or size and complexity.

#### 3.1.1 Function

- **Rural settlements** are mainly **unifunctional** (they have one main function) with only **primary** economic activities occurring, e.g. farming, fishing, mining or forestry.
- **Urban settlements** are **multifunctional** (they have many functions), i.e. they have both **secondary** activities (factories/manufacturing) and **tertiary** activities (services).
### 3.1.2 Size and complexity

- Settlements are classified from the smallest to the largest.
- A farmstead, hamlet and village are **rural settlements**.
- A town, city, metropolis, conurbation and megalopolis are **urban settlements**.

Study Figure 3.1 below to understand the differences in size and complexity of rural and urban settlements.

<table>
<thead>
<tr>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Farmstead</strong></td>
<td><strong>Town</strong></td>
</tr>
<tr>
<td>A single farm and outbuildings</td>
<td>A densely populated urban area, e.g. Harrismith or Beaufort West</td>
</tr>
<tr>
<td></td>
<td><strong>City</strong></td>
</tr>
<tr>
<td></td>
<td>A loose grouping of a few farmsteads</td>
</tr>
<tr>
<td></td>
<td><strong>Metropolis</strong></td>
</tr>
<tr>
<td></td>
<td>A denser grouping of many farmsteads</td>
</tr>
<tr>
<td></td>
<td><strong>Conurbation</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Megalopolis</strong></td>
</tr>
<tr>
<td></td>
<td>A gigantic urban complex formed when a number of conurbations join, e.g. Boston, New York and Washington (Bonywash)</td>
</tr>
</tbody>
</table>

**Figure 3.1: Size and complexity of settlements**

It is important to be able to classify settlements according to their function, size and complexity, and pattern.
Activity 3.1

Complete the table to illustrate your understanding of the classification of settlements as either rural or urban.

<table>
<thead>
<tr>
<th></th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function (activity)</td>
<td>(1 \times 2 = 2)</td>
<td>(1 \times 2 = 2)</td>
</tr>
<tr>
<td>Size and complexity</td>
<td>(3)</td>
<td>(5)</td>
</tr>
</tbody>
</table>

Answers to activity 3.1

<table>
<thead>
<tr>
<th></th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function (activity)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unifunctional</td>
<td>✓✓</td>
<td>✓✓</td>
</tr>
<tr>
<td>Multifunctional</td>
<td>✓✓</td>
<td>✓✓</td>
</tr>
<tr>
<td>Size and complexity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmstead, hamlet,</td>
<td>✓✓</td>
<td>✓✓</td>
</tr>
<tr>
<td>village</td>
<td>(3)</td>
<td>(5)</td>
</tr>
</tbody>
</table>

3.2 Rural settlements

Rural settlements are the smallest settlements which are unifunctional. They are farmsteads, hamlets or villages, where primary activities (farming, fishing, forestry or mining) take place. Figure 3.2 illustrates a rural settlement.

Figure 3.2: A rural settlement
3.2.1 Rural settlement patterns
A rural settlement pattern refers to whether the farmsteads are grouped together or not. There are two rural settlement patterns:

- **Nucleated pattern**: Farmsteads are arranged close to one another. Figure 3.3A (below left) shows a nucleated pattern. These buildings are rural, so they cannot be classified as being larger than a hamlet or village.
- **Dispersed pattern**: Farmsteads are arranged far apart from one another. Figure 3.3B (below right) shows a dispersed pattern. This can only be an isolated farmstead – this is one farm house, stables or sheds or kraals, and surrounding fields.

In an exam you may be asked to identify the pattern of settlement (nucleated or dispersed). Learn Figures 3.3A and 3.3B below to enable you to answer this question.

![Figure 3.3A: Nucleated rural pattern](image1)

![Figure 3.3B: Dispersed rural pattern](image2)

**Table 3.1: Advantages and disadvantages of living in a dispersed or nucleated rural settlement**

<table>
<thead>
<tr>
<th>Nucleated rural settlement</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advantages</td>
<td></td>
</tr>
<tr>
<td>More interaction with people</td>
<td>Not enough privacy</td>
</tr>
<tr>
<td>Safer as there are more people</td>
<td>There may be arguments as you have to agree on how to solve a problem</td>
</tr>
<tr>
<td>Can share ideas on how to solve a problem</td>
<td>Have to share the profits</td>
</tr>
<tr>
<td>Can share the cost of tools and machinery</td>
<td>Cannot use tools or machinery when you want to</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dispersed rural settlement</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advantages</td>
<td>Disadvantages</td>
</tr>
<tr>
<td>More privacy</td>
<td>Not enough interaction with people</td>
</tr>
<tr>
<td>Can make your own decisions</td>
<td>Not as safe as it is far from other people</td>
</tr>
<tr>
<td>All the profit is your own</td>
<td>Have to pay for all costs by yourself</td>
</tr>
<tr>
<td>Better use of machinery and tools</td>
<td>Difficult to share ideas when you have a problem</td>
</tr>
</tbody>
</table>

When you learn these advantages and disadvantages remember that:
- If it is an advantage for nucleated it will be a disadvantage for dispersed
- If it is a disadvantage for dispersed it will be an advantage for nucleated.
3.2.2 Reasons for the location of rural settlements

Where a settlement occurs is referred to as its location. We will discuss the location of settlements under the headings site and situation.

- The site of a rural settlement refers to the exact piece of ground the settlement is found on.
- The situation of a settlement refers to the settlement in relation to its surrounding environment.

Figure 3.4 below illustrates the relationship between the site and the situation of a settlement.

**Figure 3.4: Site and situation of a settlement**

### 3.2.2A Site of a rural settlement

When choosing a site for rural settlements, the following factors are considered:

- Availability of water
- Arable (fertile) land
- Pastoral (grazing) land
- Building materials
- Fuel such as wood from a forest

### 3.2.2B Situation of a settlement

When choosing a situation for rural settlements the following factors are considered:

- Above the flood line away from a river
- On the north-facing slope for warmer temperatures
- In the thermal belt for warmer night time temperatures
- Next to a road for accessibility

In an exam you may be asked to identify factors that affected the choice of a particular settlement in a diagram. In this type of question if a key is given, study it carefully to help you answer the question. Learn the information above to help you answer this question.
### Activity 3.2

Study the two rural settlement diagrams in Figures 3.5A and 3.5B and complete the table.

![Figures 3.5A and 3.5B](image)

<table>
<thead>
<tr>
<th></th>
<th>Figure 3.5A</th>
<th>Figure 3.5B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td>(1 x 2 = 2)</td>
<td>(1 x 2 = 2)</td>
</tr>
<tr>
<td><strong>Settlement pattern</strong></td>
<td>(1 x 2 = 2)</td>
<td>(1 x 2 = 2)</td>
</tr>
<tr>
<td><strong>Factors affecting the site</strong></td>
<td>(1 x 2 = 2)</td>
<td>(1 x 2 = 2)</td>
</tr>
<tr>
<td><strong>Factors affecting the situation</strong></td>
<td>(1 x 2 = 2)</td>
<td>(1 x 2 = 2)</td>
</tr>
</tbody>
</table>

### Answers to activity 3.2

<table>
<thead>
<tr>
<th></th>
<th>Figure 3.5A</th>
<th>Figure 3.5B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td>Rural/unifunctional ✓ ✓ (2)</td>
<td>Rural/unifunctional ✓ ✓ (2)</td>
</tr>
<tr>
<td><strong>Settlement pattern</strong></td>
<td>Nucleated ✓ ✓ (2)</td>
<td>Dispersed/isolated ✓ ✓ (2)</td>
</tr>
<tr>
<td><strong>Factors affecting the site</strong></td>
<td>Arable land ✓ ✓ (any 1) (2)</td>
<td>Arable land ✓ ✓ Drinking water ✓ ✓ (any 1) (2)</td>
</tr>
<tr>
<td></td>
<td>Grazing land ✓ ✓ (any 1)</td>
<td>Grazing land ✓ ✓ (any 1) (2)</td>
</tr>
<tr>
<td><strong>Factors affecting the situation</strong></td>
<td>Away from water ✓ ✓ (any 1) (2)</td>
<td>Away from water ✓ ✓ Dry point settlement ✓ ✓ (any 1) (2)</td>
</tr>
<tr>
<td></td>
<td>Near a road for transport ✓ ✓</td>
<td>Near a road for transport ✓ ✓ (any 1)</td>
</tr>
</tbody>
</table>
3.2.3 Rural-urban migration

As countries develop and urban areas expand, more and more people move from the rural areas to cities and towns. This movement of people from a rural area to an urban area is called rural-urban migration.

In this section we look at the factors that cause people to leave the rural areas (push factors) and move to the urban areas (pull factors). We will also look at what governments do to keep people in the rural areas.

3.2.3A Push and pull factors causing people to leave the rural areas

Table 3.2 below summarises the factors that make people want to leave the rural areas and move to cities.

<table>
<thead>
<tr>
<th>Push factors</th>
<th>Pull factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural disasters, such as drought or floods, have a greater impact in rural areas.</td>
<td>Natural disasters have a smaller impact; government provides more help to urban areas during droughts and floods.</td>
</tr>
<tr>
<td>Lack of facilities in rural areas, e.g. fewer schools, colleges or universities, and fewer hospitals or clinics in rural areas</td>
<td>Better and more access to education and medical facilities in urban areas</td>
</tr>
<tr>
<td>Lack of services in rural areas, e.g. water, electricity, transport</td>
<td>Better access to services in urban areas, e.g. water, electricity, transport</td>
</tr>
<tr>
<td>Lack of employment in rural areas – few jobs are available and there is little variety in the types of jobs available</td>
<td>More jobs and more types of jobs available in urban areas</td>
</tr>
<tr>
<td>Lack of housing in rural areas</td>
<td>More housing and better housing available in urban areas</td>
</tr>
<tr>
<td>Lack of recreational facilities, entertainment and social interaction in rural areas</td>
<td>More recreational facilities, entertainment and social interaction in urban areas</td>
</tr>
<tr>
<td>Poverty in rural areas, which limits people's chances of improving their standard of living.</td>
<td>Better standard of living possible in urban areas</td>
</tr>
</tbody>
</table>

Table 3.2: Push and pull factors
3.2.3B Government strategies for keeping people in the rural areas

Rural to urban migration causes many problems in rural and urban areas. Because of this, the government has various solutions or strategies (plans) to keep people in rural areas and to attract people back to rural areas. **Agenda 21 is a broad strategy to develop rural areas.** Some of the basic ideas are included in the list below:

- Before you can implement a solution, it is important to speak to the local people and get their ideas on how to improve the area.
- Solutions should look to use the skills and talents of the local people.
- Basic needs (food, shelter, clothing and clean running water) must be satisfied before other development can happen.
- Improve services (like electricity and roads) and facilities (like hospitals and schools) to encourage people to stay in the area.
- When providing for these basic needs, such as building roads or clinics, use local labour and train people so they can use their new skill or trade to earn a living in the area.
- Improve food security by educating farmers in the use of better farming methods, tools and seeds.
- Attract secondary activities, like factories, to rural areas. Encourage these industries to use local raw materials and skills to ensure rural people are employed.

Rural depopulation does not only affect rural areas but also small towns. Many people are leaving small towns to move to the big cities. Below are some basic ideas to consider when improving small towns:

- Improve roads to and from the small town.
- Upgrade facilities in the small town.
- Town councils must find ways to advertise their town to attract tourists or people to come and live there, for example:
  - Build old age homes and offer services specifically for older people. This would attract older people to retire to the small town.
  - Develop a holiday resort, or attract people for weekend getaways to the small town.
3.3 Urban settlements

Urban settlements are towns or cities where secondary and tertiary activities take place. More and more people are living in urban areas so towns are growing larger and more complex all the time. Figure 3.6 below shows an urban settlement.

3.3.1 Reasons for the location of urban settlements

Where a settlement is found or occurs is referred to as its location.

3.3.1A Site of an urban settlement

When choosing a site for urban settlements, the following factors are considered:

- **Availability of water**: This is no longer as relevant, since water can be piped over long distances.
- **Soil**: People prefer to build on soil which allows water to drain through it. It is difficult to build on clay because water collects on top of this type of soil.
- **Rock structure**: Sites which are far from sinkholes, fault lines and volcanoes are better to build on.
- **Relief**: Sites with gentle gradients are preferred, as building costs are cheaper.
- **Transport and trade**: Development often occurs at a river crossing.
- **Human factors**: Sites with historical, cultural or social value attract people to live in the area.

In an exam you may be asked to identify factors that affected the choice of a particular settlement in a diagram. In this type of question, if a key is given look at it carefully to help you answer the question. Learn the information (left) to help you answer this question.
3.3.2 Types of urban settlements

Urban areas are classified according to their function (the main reason why they are there). There are three main types of urban areas:

- Central places
- Trade and transport towns or cities
- Specialised town or cities

Table 3.3 summarises the three types of urban areas.

<table>
<thead>
<tr>
<th>1. Central places</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small towns supplying urban goods and services to surrounding rural areas</td>
</tr>
<tr>
<td><strong>Low order good/service</strong></td>
</tr>
<tr>
<td>• Need often (bread, milk, doctor)</td>
</tr>
<tr>
<td>• Smaller threshold population</td>
</tr>
<tr>
<td>• Several shops/services</td>
</tr>
<tr>
<td><strong>High order good/service</strong></td>
</tr>
<tr>
<td>• Don't need or need less often (e.g. TV, health spa)</td>
</tr>
<tr>
<td>• Larger threshold population</td>
</tr>
<tr>
<td>• Few shops/services</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Trade/transport towns or cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop where transport routes meet</td>
</tr>
<tr>
<td><strong>Break of bulk</strong></td>
</tr>
<tr>
<td>Transport changes, e.g. from sea to land</td>
</tr>
<tr>
<td>Example: Durban</td>
</tr>
<tr>
<td><strong>Junction</strong></td>
</tr>
<tr>
<td>Intersection of two main transport routes</td>
</tr>
<tr>
<td>Example: De Aar (Touws River)</td>
</tr>
<tr>
<td><strong>Gap</strong></td>
</tr>
<tr>
<td>Point of access at physical barrier (e.g. mountain pass)</td>
</tr>
<tr>
<td>Example: De Doorns (Hex River Pass)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Specialised towns or cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop because of one main function in the area</td>
</tr>
<tr>
<td><strong>Mining</strong></td>
</tr>
<tr>
<td>Example: Kimberley</td>
</tr>
<tr>
<td><strong>Education</strong></td>
</tr>
<tr>
<td>Example: Grahamstown</td>
</tr>
<tr>
<td><strong>Industrial</strong></td>
</tr>
<tr>
<td>Example: Secunda</td>
</tr>
<tr>
<td><strong>Resort</strong></td>
</tr>
<tr>
<td>Example: Margate</td>
</tr>
<tr>
<td><strong>Commuter/dormitory</strong></td>
</tr>
<tr>
<td>Example: Soweto</td>
</tr>
</tbody>
</table>

Use the word CRIME to help you remember the different types of specialised towns:

- C - Commuter
- R - Resort
- I - Industrial
- M - Mining
- E - Education

Make up your own mnemonics to remember the facts about these three types of urban areas (see page xi in the introduction to learn more about mnemonics).
3.3.2A Central places

Central places are small towns that supply urban services to the surrounding rural area. They have shops that sell basic goods or provide basic services to people who live and work on the farms in the area. Goods or services may be classified as low or high order. Study Table 3.4 below to learn the differences between low and high order goods or services.

<table>
<thead>
<tr>
<th></th>
<th>Low order goods/services</th>
<th>High order goods/services</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition</strong></td>
<td>A function or good you need or buy often</td>
<td>A function or good you buy less often or do not need on a regular basis</td>
</tr>
</tbody>
</table>
| **Examples**            | Low order goods: bread, milk, petrol  
Low order services: doctors, mechanics | High order goods: television, designer shoes  
High order services: specialist doctors, health spas |
| **Threshold population**| Smaller number of people | Larger number of people |
| **Number of these shops or services** | Many – people want to buy low order goods and services on a regular basis | Few – people do not need high order goods and services very often |

Table 3.4: Low and high order goods or services

- **Threshold population**: The number of people a function must serve in order to be profitable, or the number of people needed to support a function or town. Threshold population refers to how many customers a shop or service must have in order to be profitable.
- **Range**: The distance a person will travel to obtain a particular good or service. Range refers to how far someone will travel to buy a particular product or access a particular service.
- **Sphere of influence or service area**: The area served by a business selling a particular good or service. This is the area where people live who buy goods from a particular shop or use a particular service.

**Activity 3.3**

1. Expand the blank diagram in Figure 3.7A below and use the following terms to add a key to the diagram:
   a) Threshold population  
   b) Range  
   c) Sphere of influence

   ![Figure 3.7A](image)

2. Write definitions to show your understanding of the terms in a), b) and c).
   (1 × 2 = 2)  
   (1 × 2 = 2)  
   (1 × 2 = 2)  
   (3 × 2 = 6)
Answers to activity 3.3

1.

**Figure 3.7B**

2. a) The minimum number of people needed to maintain a settlement or function ✓ ✓ (2)
   
   b) The maximum distance people are prepared to travel to a settlement or a function ✓ ✓ (2)
   
   c) The maximum area served by a settlement or function ✓ ✓ (2)

3.3.2B Trade and transport towns or cities

These are towns or cities which develop at a point where transport routes meet. Easy access to trade and transport in the area is the reason why people settle there.

There are three types of trade and transport cities:

- **Break-of-bulk towns or cities**: They develop at a point where the type of transport changes. This is most often at a harbour where the transport changes from sea to land.
- **Junction towns or cities**: They develop at an intersection of two major transport routes, for example a railway junction.
- **Gap towns or cities**: They develop at a point of access through or over a physical barrier, for example at a mountain pass.

3.3.2C Specialised towns or cities

These are towns or cities which have developed because of one main or dominant function occurring in the area. If the function were to stop then the city would be at risk of becoming a ghost town (a deserted town).

Examples of specialised towns or cities are:

- Mining towns or cities, e.g. Kimberley
- Education towns or cities, e.g. Grahamstown
- Industrial towns or cities, e.g. Secunda, Sasolburg
- Resort towns or cities, e.g. Margate
- Dormitory or commuter towns or cities, e.g. Soweto

In an exam, you may be asked to identify the type of trade and transport city in a diagram. If a key is given, look at it carefully to help you answer the question. Learn the information above to help you answer this question.
3.3.3 Structure of an urban area

The study of an urban area involves focusing on the following three aspects:

- Urban profile
- Urban street patterns
- Urban land use zones

3.3.3A Urban profile

An urban profile is a view of the urban area from the side, like looking at the side view of a person’s face. We call the side view a profile. A profile is seen in cross section drawings.

Figure 3.8 below shows a cross section of an urban profile.

![Urban Profile Diagram]

When we study an urban profile we take note of the **height**, the **density** of the buildings, and **land value**.

- **Looking at the city from the centre towards the outskirts**
  The height of the buildings decreases the further away you go from the centre of the city. The density (how many buildings there are in an area) also decreases the further you go from the city centre. The reason for the decrease in density and height is because land value decreases as you move away from the centre of the city.

- **Looking at a city from the outskirts towards the centre**
  The height of the buildings increases the closer you get to the city centre. The density of the buildings also increases the closer you get to the city centre.

- **Thinking about land value**
  Land value in the centre of the city is very high because it is in high demand (lots of people value it and want to live or work there). The land value decreases the further you go from the city centre. The density and height in the centre of the city is highest because of the high land value. People must make maximum use of the land. This is why there are many high-rise buildings in the city centre. Due to the high land value in the city centre, certain functions will move to the outskirts of the city, such as factories, businesses and residential (houses). Factories and business are often located in specific areas known as industrial or office parks. Houses are located in residential suburbs.
Figure 3.9 below shows the urban profile and how the land value decreases from the central business district (CBD) towards the outskirts of the urban area.

- **Suburban office park** (also called outlying business district): Landscaped offices in suburbs; parking available; peaceful surroundings
- **CBD (Central Business District)**: Tallest buildings; most expensive land; centre of business activity; accessible to all
- **Suburban shopping centre**: Large shopping centres in residential suburbs; lots of parking available; entertainment and retail (shops)
- **Urban–rural fringe**: On outskirts of built-up area; smallholdings, golf courses; horse-riding stables; plant nurseries; cemeteries; land not so expensive
- **High-income residential**: Large; expensive homes; swimming pools; tennis courts; big grounds
- **Low-cost housing/informal settlement**: Residential; high density; basic services not always available
- **Transitional zone**: Around CBD; old buildings, usually run-down; mixed land use e.g. warehouses and industry; some redevelopment
- **Industrial zone**: Factories (heavy and light industry); out of town; noisy and dirty; needs to be close to transport routes

**Figure 3.9: Urban profile showing decrease in land value from the CBD towards the outskirts of the urban area**

**Activity 3.4**

1. On the urban profile shown in Figure 3.8 on page 71 draw a line graph to show how land value changes as you move towards the CBD. (1 × 2 = 2)
2. How does building density change as you move towards the centre of the city? (1 × 2 = 2)
3. Explain your answer in question 2. (2 × 2 = 4)
4. Why would an office park move away from the Central Business District? (2 × 2 = 4)
Answers to activity 3.4

1. [Graph showing Land value vs City profile]

2. The density of the buildings increases. ✓ ✓ (2)

3. The land is very expensive in the CBD so many buildings are built closer together and on smaller pieces of land. ✓ ✓ (4)

4. Land value is cheaper ✓ ✓/There is less traffic congestion ✓ ✓/
   - It is closer to clients ✓ ✓/There is less noise ✓ ✓/There is more parking ✓ ✓
   (any 2) (4)[12]

3.3.3B Urban street patterns

The structure of an urban area can be studied from above by looking at the patterns formed by the streets of the urban area. The layout or arrangement of the roads is called the street pattern. In this section we focus on four street patterns:

- Gridiron
- Radial
- Planned irregular
- Unplanned irregular

Study Figures 3.11A to D (below and on page 74) to understand the four street patterns.

**Gridiron street pattern**
- The roads intersect at right angles, forming rectangular blocks.
- Found in the CBD and older cities

**Advantages of the gridiron street pattern**
- Easy to find way around (cannot get lost)
- Land can be divided up easily
- Can be converted into one-way streets to ease traffic congestion
- Shorter distance to travel
- Little wastage of land

**Disadvantages of the gridiron street pattern**
- Traffic congestion as traffic stops at every intersection
- More accidents because of intersections
- Monotonous (boring) suburb layout

[Figure 3.11A: Gridiron street pattern]
### Radial street pattern
- The roads spread out from a central point, similar to a spider’s web.
- Found in very old cities like Paris in Europe or Kimberley in South Africa. It is also found in more recently planned cities like Sasolburg in South Africa.

#### Advantages of the radial street pattern
- Easier flow of traffic
- All roads lead to central point in town, for example place of worship, monument, town square, etc.

#### Disadvantages of the radial street pattern
- Traffic jams are common as all roads lead to the centre
- Traffic is slow as there are no shortcuts
- Space is wasted

![Figure 3.11B: Radial street pattern](image)

### Planned irregular street pattern
- The roads have few intersections and curve a lot.
- Found in modern cities and newer suburbs

#### Advantages of planned irregular street pattern
- Improves the flow of traffic
- Roads are quieter because there are fewer intersections and less through-traffic
- Interesting suburb layout because of unexpected turns in the road
- Accommodates the nature of the topography

#### Disadvantages of planned irregular street pattern
- It is easy to get lost.
- It is not easy to subdivide or expand.

![Figure 3.11C: Planned irregular street pattern](image)

### Unplanned irregular street pattern
- There is no clear design or plan to these roads.
- Typical of informal settlements

#### Advantages of unplanned street pattern
- One of a kind (unique) pattern

#### Disadvantages of unplanned street pattern
- Traffic congestion
- Unplanned/no order
- Get lost easily

![Figure 3.11D: Unplanned irregular street pattern](image)

### 3.3.3 Urban land use zones
The structure of an urban area can be studied by looking at the different land use zones in a city. A land use zone is an area which has features that define its function. For example, a residential area is made up of houses or flats, recreational areas, schools and shops. These features tell us that people live in the area. Another example is an industrial area, which is made up of many large buildings (factories), major transport routes and few open or green areas.
The photographs and some orthophotos in Figures 3.12A to I below show different land use zones and their features. An orthophoto is an aerial photograph that has been geometrically corrected so that the scale is uniform and there is no visual distortion. Remember, aerial means ‘seen from above’.

<table>
<thead>
<tr>
<th>Description</th>
<th>Photograph</th>
<th>Orthophoto</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Central Business District (CBD)</strong></td>
<td><img src="image1" alt="Figure 3.12A1" /></td>
<td><img src="image2" alt="Figure 3.12A2" /></td>
</tr>
<tr>
<td>• In the city centre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Highest land values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Most accessible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Highest building density</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Tallest buildings</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Transition zone</strong></td>
<td><img src="image3" alt="Figure 3.12B" /></td>
<td></td>
</tr>
<tr>
<td>• Zone of mixed and changing land use, e.g. residential becoming commercial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Often a zone of decay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Landlords are not maintaining the area or buildings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Working class residents live here, in high-density flats or small houses.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Light industry</strong></td>
<td><img src="image4" alt="Figure 3.12C1" /></td>
<td><img src="image5" alt="Figure 3.12C2" /></td>
</tr>
<tr>
<td>• Often near the CBD or in planned industrial estates (areas where government plans to provide needed power and transport for factories)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Found near road transport as raw materials are often transported more easily in this way</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Little noise and air pollution created by these industries</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See if you can find examples of these land use zones in the area where you live.
<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th><strong>Photograph</strong></th>
<th><strong>Orthophoto</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heavy industry</strong></td>
<td><img src="image" alt="Figure 3.12D" /></td>
<td></td>
</tr>
<tr>
<td>• Found on the outskirts of the city where land is cheapest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Found near major road and rail networks for transport of raw materials and finished products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Often low-income housing is found nearby</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Heavy air and noise pollution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Need to be on flat land, near a water source</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Middle- to high-income residential/upper class residential**

- Found away from the CBD
- Often have a good view
- Townhouses and big houses
- Larger properties as more space is available
- Good services and facilities, including recreation areas

![Figure 3.12E1](image) ![Figure 3.12E2](image)

**Low-income residential/working class residential**

- Buildings very close together
- Close to business area
- Fewer facilities and poor services
- Small blocks
- Buildings look the same

![Figure 3.12F](image)

**Informal settlement**

- Found on the city outskirts
- No service delivery (no roads, sanitation, water, electricity or schools)
- High poverty levels
- High crime rates
- Houses are built out of plastic, wood, zinc, etc
- Unhealthy conditions
- Very dense housing with unplanned street patterns

![Figure 3.12G](image)
<table>
<thead>
<tr>
<th>Description</th>
<th>Photograph</th>
<th>Orthophoto</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green belt/recreation</td>
<td><img src="image1.png" alt="Figure 3.12H1" /></td>
<td><img src="image2.png" alt="Figure 3.12H2" /></td>
</tr>
<tr>
<td>• No buildings in this area</td>
<td><img src="image3.png" alt="Figure 3.12I1" /></td>
<td><img src="image4.png" alt="Figure 3.12I2" /></td>
</tr>
<tr>
<td>• Used for public gardens, parks and sports fields. Area has many trees and lawns.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Helps to clean the air in urban areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Calms traffic and reduces noise levels</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rural urban fringe**

• Mixed land use with both urban and rural functions
• Urban functions like rubbish dumps, airports, cemeteries and golf courses
• Land use starting to change from rural to urban as city expands
• Large properties because land here is often cheaper
• Less developed areas
• Plots and smallholdings
Land use zones and mapwork interpretation

It is important that you understand how to identify land use zones on a topographic map or orthophoto, as this is a frequently asked question in the Mapwork section of the exam (Paper 2).

**Central Business District**
- In centre of the town
- Has a grid iron pattern
- Transport routes meet here

**Working class residential zone**
- Near CBD or industrial area or sewage disposal works or railway line
- Very small blocks (grey blocks on a map show built-up areas)

**Upper class residential areas**
- On outskirts of town (but not near factories or sewage works)
- Near to golf courses or the sea
- Large grey blocks

**Heavy industry**
- On outskirts of town
- Next to main transport routes (highway or railroad)
- Near a river
- Indicated by large blocks on the map

In Paper 1 and Paper 2 you may be asked to identify the land use zones seen in diagrams, cartoons, photographs and on a topographic map or on an orthophoto. You may also be asked to describe the characteristics of the land use zone. Learn the above information to help you answer the question.
Activity 3.5

This activity is a mapwork interpretation of a settlement. Refer to the topographic map 2530BD Nelspruit and the orthophoto map extract at the back of this study guide and answer the following questions.

1. Nelspruit/Mbombela is the capital of which South African province? (1 × 2 = 2)

2. a) What factors influenced the site of Nelspruit/Mbombela? (4 × 2 = 8)
b) Discuss the situation of Nelspruit/Mbombela. (3 × 2 = 6)

3. a) Identify the settlement pattern in block C2. Give a reason to support your answer. (2 × 2 = 4)
b) What is the shape of the settlement in block B3? Why do you think it has taken this shape? (2 × 2 = 4)

4. Classify the type of farming in block C3 as fully as possible, explaining your answer. (3 × 2 = 6)

5. a) What is different about the farm Friedenheim in block C5? (1 × 2 = 2)
b) How could this farm help to prevent rural–urban migration? (1 × 2 = 2)

6. What type of city would Nelspruit/Mbombela be classified as? Explain your answer. (2 × 2 = 4)

7. a) Give the block reference of the land use zone known as the CBD. (1 × 2 = 2)
b) Draw a simple cross section sketch to illustrate the urban profile of the land use zone in question a). (2 × 2 = 4)
c) What type of street pattern is found in this zone? Give two advantages and two disadvantages for this street pattern. (5 × 2 = 10)

8. West Acres is an example of an upper income residential area. Give two reasons from the map to support this statement. (2 × 2 = 4)

Study the orthophoto at the back of the study guide.

9. What land use is found at A, B, C and D? (4 × 2 = 8)

10. The residents of West Acres do not like travelling to the centre of Nelspruit/Mbombela to do their shopping as it has become so congested. Where would you suggest that they build a new shopping mall? Explain why you have chosen this site to build on. (3 × 2 = 6)
Answers to activity 3.5

1. Nelspruit/Mbombela is the capital of Mpumalanga province.✓✓ (2)

2. a) Analysis of the site of Nelspruit/Mbombela:
   - Near water from the river✓✓
   - Arable land from the river valley✓✓
   - Possible building material from the surrounding hills✓✓
   - Possible fuel from the vegetation on the slopes✓✓ (8)

   b) Discussion of the situation of Nelspruit/Mbombela:
      i) Topography: It is on the valley floor so easy to establish✓✓
         Gap city between the mountains✓✓
      ii) Gradient: The city is built on flat land for the large
         buildings✓✓/Residential areas are more on the slopes✓✓
      iii) River: Buildings on the inner bank away from possible
         flooding✓✓
      iv) Transport: On the main road to Mozambique on N4✓✓
         Links to the west–east and north–south✓✓/Part of
         Maputo Corridor✓✓ (any 3 facts) (6)

3. a) Block C2 is a nucleated settlement pattern.✓✓
    The buildings are close to one another.✓✓✓ (4)

   b) The settlement in block B3 has a linear shape✓✓. It lies along
    the road/along a contour so that it is easy to build on the
    same height above sea level/altitude✓✓. (4)

4. The type of farming in block C3 is commercial farming✓✓.
   The farm is large✓✓/The farmer lives on his farm and has
   maximum control✓✓/The farm is near to the road for easy
   transport✓✓ (any 3 facts) (6)

5. a) The farm Friedenheim in block C5 is an experimental farm.
   It has a research/education function✓✓. (2)

   b) This farm can help to prevent rural–urban migration because:
      It creates work for the people living in the area and people
      can migrate back to the area✓✓/It supports Agenda 21,
      enabling people to become more independent or able to
      make a living✓✓✓ (any 1 fact) (2)

6. Nelspruit (Mbombela) can be classified as any one of the
   following:
      Central place – there is a lot of farming in the area so Nelspruit
      offers urban services to the surrounding rural area, e.g. market
      for farm produce, schools for rural children to attend✓✓✓✓.
      Trade and transport city – it is built where two major roads
      meet✓✓✓✓.
      Gap city – it is built in the valley between mountains✓✓✓✓.
      (any 1) (4)

7. a) The land use zone known as the CBD is in block E4 on the
    map✓✓ (2)

Mind the Gap
Geography

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b) Simple cross section sketch to illustrate the urban profile of this land use zone:

![Cross section sketch](image)

Figure 3.13

(4)

c) This zone has a gridiron street pattern.

<table>
<thead>
<tr>
<th>Advantages (any 2)</th>
<th>Disadvantages (any 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Easy to find your way around (cannot get lost)✓✓</td>
<td>• Traffic congestion as traffic stops at every intersection✓✓</td>
</tr>
<tr>
<td>• Land can be divided up easily✓✓</td>
<td>• More accidents because of intersections✓✓</td>
</tr>
<tr>
<td>• Can be converted into one-way streets to ease traffic congestion✓✓</td>
<td>• Heavy traffic causes road rage✓✓</td>
</tr>
<tr>
<td>• Shorter distance to travel✓✓</td>
<td>• More pollution from cars✓✓</td>
</tr>
<tr>
<td>• Little wastage of land✓✓</td>
<td>• Monotonous (boring) town layout✓✓</td>
</tr>
</tbody>
</table>

(10)

8. West Acres is an example of an upper income residential area. Two reasons evident on the map to support this statement:

• Away from the CBD✓✓
• It has large blocks of land between the roads✓✓
• Street pattern is planned irregular✓✓
• It is on the warmer, north-facing slope so land will be more expensive✓✓
• Away from pollution and noise✓✓

(Any 2) (4)

Questions based on the orthophoto:

9. Land use found at A, B, C and D:

A = Transport (railway station)/Industrial✓✓
B = Commercial/Business - CBD✓✓
C = Residential✓✓
D = Recreation/Showground✓✓

(8)

10. The best place for a shopping mall for the residents of West Acres would be near E on the orthophoto. The reasons are as follows:

• The land is not being used for other purposes✓✓
• It is near a road so people living nearby can get there easily✓✓
• It is close to the suburb West Acres✓✓
• The land here is quite flat (as indicated by the contours that are far apart)✓✓

(Any 3 reasons) (6)
3.3.4 Urban problems

As an urban area grows and more people move into the area, certain problems are created and get worse as the city gets bigger. These problems are often worse in the CBD.

In this section we focus on the following three urban problems:

- Congestion
- Urban decay
- Centralisation

<table>
<thead>
<tr>
<th>Problem: Congestion (too many cars on the roads)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Causes</strong></td>
</tr>
<tr>
<td>• Too many people using own cars</td>
</tr>
<tr>
<td>• Not enough public transport</td>
</tr>
<tr>
<td>• Old street planning</td>
</tr>
<tr>
<td><strong>Effect</strong></td>
</tr>
<tr>
<td>• Increased air pollution</td>
</tr>
<tr>
<td>• More accidents</td>
</tr>
<tr>
<td>• More stress and health problems; road rage</td>
</tr>
<tr>
<td><strong>Solution</strong></td>
</tr>
<tr>
<td>• Improve public transport</td>
</tr>
<tr>
<td>• Have lift schemes</td>
</tr>
<tr>
<td>• Encourage some businesses to move out of the CBD</td>
</tr>
<tr>
<td>• Synchronize traffic lights</td>
</tr>
</tbody>
</table>

Table 3.5: Causes, effects and solutions to the urban problem of congestion

<table>
<thead>
<tr>
<th>Problem: Urban decay (where parts of the city are not looked after or are over-used)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Causes</strong></td>
</tr>
<tr>
<td>• CBD moving into residential areas</td>
</tr>
<tr>
<td>• Too many people living in city</td>
</tr>
<tr>
<td>• Unoccupied/empty buildings</td>
</tr>
<tr>
<td><strong>Effect</strong></td>
</tr>
<tr>
<td>• Slums develop</td>
</tr>
<tr>
<td>• Services and facilities decline</td>
</tr>
<tr>
<td>• Increased pollution</td>
</tr>
<tr>
<td>• Area becomes dirty and neglected (not looked after)</td>
</tr>
<tr>
<td><strong>Solution</strong></td>
</tr>
<tr>
<td>• Get people in slums to help fix up their area, increase their ownership of buildings</td>
</tr>
<tr>
<td>• Improve and upgrade services and facilities</td>
</tr>
</tbody>
</table>

Table 3.6: Causes, effects and solutions to the urban problem of urban decay

<table>
<thead>
<tr>
<th>Problem: Centralisation (too many people and activities moving into the city, close to centre)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Causes</strong></td>
</tr>
<tr>
<td>• High demand for land in city</td>
</tr>
<tr>
<td>• Too many people living in city</td>
</tr>
<tr>
<td><strong>Effect</strong></td>
</tr>
<tr>
<td>• Increased pollution</td>
</tr>
<tr>
<td>• Increase in health problems</td>
</tr>
<tr>
<td>• Increased destruction of environment</td>
</tr>
<tr>
<td>• Overuse of resources</td>
</tr>
<tr>
<td>• Production of too much waste</td>
</tr>
<tr>
<td><strong>Solution</strong></td>
</tr>
<tr>
<td>• Move certain functions out of city</td>
</tr>
<tr>
<td>• Stricter controls on all types of pollution</td>
</tr>
<tr>
<td>• Develop more green belts</td>
</tr>
</tbody>
</table>

Table 3.7: Causes, effects and solutions to the urban problem of centralisation

In an exam you may be asked to state the causes or effect or solution to an urban problem. You may also be asked to describe the causes or effect or solution to an urban problem in a paragraph.
**Activity 3.6**

Refer to Figure 3.14 below, which shows a settlement typical of the South African urban landscape. It shows urban functions or services of a low and a high order.

---

1. a) What is a settlement? 
   b) Is the settlement shown in Figure 3.14 a rural or an urban settlement? 
   c) Give one reason for your answer to question b) above. 

2. a) Distinguish between a low-order function and a high-order function. 
   b) From Figure 3.14, identify one low-order function and one high-order function. 
   c) Explain the meaning of the term sphere of influence of a function or service. 
   d) Will the bank or the café have a larger sphere of influence? 
   e) Explain your answer to question d) above. 

3. a) The bakery is an example of a light industry. What is a light industry? 
   b) Unlike a heavy industry, the bakery can be located close to the hospital. Explain why this bakery does not have to be located outside the city. 
   c) Why is it important for the bakery to have a central location? 

4. a) With reference to Figure 3.14, explain why many people from the surrounding rural areas are attracted to this settlement. 
   b) Explain why it is important for the illustrated settlement to slow down the movement of people from rural areas to this settlement.
### Answers to activity 3.6

1. a) A settlement is a grouping of people, buildings, communication networks and activities that function as a single, integrated system on a regular, daily basis. ✓✓
   b) It is an urban settlement. ✓✓
   c) It is multifunctional ✓✓/Secondary and tertiary functions are shown. ✓✓

2. a) Low-order function: Needed on a daily basis; has a small sphere of influence, small range and small threshold population ✓✓
    High-order function: Needed less often; has a large sphere of influence, large range and large threshold population ✓✓.
    b) Low-order: Bakery/Café/Flour mill ✓✓
    High order: SABC/Hospital/Bank/Chem-Lab Research ✓✓

3. a) A light industry is an industry that uses small quantities of raw materials and causes little pollution. ✓✓
    b) Reasons why the bakery does not have to be located outside the city:
       • Little air pollution ✓✓
       • Little noise pollution ✓✓
       • No bad odours (bad smells) ✓✓
       • No dangerous activities ✓✓
       • Only needs a small piece of land ✓✓
    c) Reasons why it is important for the bakery to have a central location:
       • Products are perishable (can go bad) ✓✓
       • Must be close to the consumers ✓✓

4. a) Reasons why people are attracted to the settlement:
    • Variety of services (e.g hospital, bank, transport) ✓✓
    • Job opportunities in many different economic activities ✓✓
    • Higher paid jobs in secondary and tertiary sectors ✓✓
    • Good infrastructure ✓✓
    • Entertainment ✓✓
Answers to activity 3.6 (continued)

b) Slowing down the rural-urban migration must happen so that it can:
   - Avoid overcrowding ✓ ✓
   - Reduce traffic congestion ✓ ✓
   - Reduce pressure on resources ✓ ✓
   - Reduce the unemployment caused by too many people coming to the city ✓ ✓
   - Reduce the problem of lower standards of living ✓ ✓
   - Reduce the problem of informal settlements being built ✓ ✓
   - Prevent a possible increase in crime ✓ ✓
   - Prevent urban decay ✓ ✓
   - Prevent the development of social problems ✓ ✓ (any 2) (4)

Activity 3.7

Refer to Figure 3.15 on page 87 based on the Cape Peninsula. Then read the text below before you answer the questions that follow.

The Cape Peninsula stretches from the Cape of Good Hope and Cape Point northwards to Table Mountain and the city of Cape Town. It comprises, for the most part, strikingly beautiful mountains, including the well-known Table Mountain which overlooks the bay and city. Its western and eastern shorelines are graced by attractive residential and resort centres that are a magnet for holiday-makers.

(Adapted from Traveller’s Guide to South Africa)

Question 1

Refer to the wine farms located in the area of Constantia. Wine farm estates are examples of isolated farmsteads.

1.1 Define the term isolated farmstead. (1 × 2 = 2)

1.2 State two economic advantages of this settlement pattern. (2 × 2 = 4)

1.3 Describe two social disadvantages of this settlement pattern. (2 × 2 = 4)

1.4 Wine farms in South Africa form part of all three economic activities: primary, secondary and tertiary activities. Explain this statement in a short a paragraph (no more than 12 lines). (6 × 2 = 12)
Figure 3.15
Question 2
Study the city of Cape Town in the centre of Figure 3.15 to answer the following questions.

2.1 Define the term site. (1 × 2 = 2)

2.2 What two factors were responsible for the site chosen for the development of Cape Town? (2 × 2 = 4)

2.3 Why is Cape Town classified as a break-of-bulk point? (1 × 2 = 2)

2.4 a) What do the letters CBD stand for? (1 × 2 = 2)
   b) Identify the street pattern of the CBD of Cape Town. (1 × 2 = 2)
   c) Provide one advantage and one disadvantage of this street pattern. (2 × 2 = 4)
   d) With reference to Figure 3.15, identify one characteristic of the CBD’s profile. (1 × 2 = 2)
   e) Explain why the CBD has the characteristic you identified in question d). (2 × 2 = 4)

2.5 What evidence is there that the CBD of Cape Town is the most accessible land use zone? (1 × 2 = 2)

Question 3
Refer to the residential areas of Sea Point and the Malay Quarters.

3.1 a) Classify the two areas as low- or high-income areas respectively. (2 × 2 = 4)
   b) Explain your classification of Sea Point in question a) by referring to evidence from Figure 3.15. (2 × 2 = 4)

3.2 The open space around the Malay Quarter may attract migrants from the rural areas.
   a) What is likely to develop here as a result of this migration? (1 × 2 = 2)
   b) Explain the occurrence of this development. (2 × 2 = 4)
   c) State two reasons for these migrants leaving the rural areas. (2 × 2 = 4)
   d) What problems are associated with this development? (2 × 2 = 4)
   e) You are part of a task team set up by the government to provide suggestions on how to slow the movement of people from the rural areas, as well as attract people back to small towns. In a short paragraph (no more than 12 lines), discuss some of your suggestions. (6 × 2 = 12)

Question 4
4.1 Provide the correct term for the following phrases:
   a) A settlement where only primary activities occur (1 × 2 = 2)
   b) An urban settlement which consists of a main city with surrounding dependant towns (1 × 2 = 2)
   c) The increase in the number of people living in an urban area (1 × 2 = 2)
4.2 Match the columns. Simply write the number of the term in Column A next to the letter of the correct phrase from Column B.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Junction town</td>
<td>i) Plans to provide basic needs to all areas</td>
</tr>
<tr>
<td>b) Zone of decay</td>
<td>ii) Farmland with a high carrying capacity</td>
</tr>
<tr>
<td>c) Centrifugal forces</td>
<td>iii) Reasons why people leave a CBD or city</td>
</tr>
<tr>
<td>d) Intensive farming</td>
<td>iv) Plans to improve the peripheral areas</td>
</tr>
<tr>
<td>e) Spatial development initiatives</td>
<td>v) An old area in the CBD</td>
</tr>
<tr>
<td></td>
<td>vi) A town formed where two rivers meet</td>
</tr>
<tr>
<td></td>
<td>vii) An area around the CBD with mixed functions</td>
</tr>
<tr>
<td></td>
<td>viii) A town formed at a point where two major transport routes meet</td>
</tr>
</tbody>
</table>

(5 × 2 = 10)  

Answers to activity 3.7

Question 1

1.1 An individual farmstead on its own piece of land. ✓✓  
1.2 All profit is your own ✓✓/Make own decisions ✓✓/Make effective use of machinery ✓✓/Less time wasted travelling to work. ✓✓ (any 2)  
1.3 Little social interaction ✓✓/Less help in times of trouble ✓✓/No sharing of ideas ✓✓. (any 2)  
1.4 Primary activities refer to the extraction of raw material from the Earth. The growing of grapes is a primary activity. ✓✓✓✓  
Secondary activities refer to the manufacturing of raw material into processed goods. Making wine from grapes is a secondary activity. ✓✓✓✓  
Tertiary activities refer to the provision of services and selling of goods. Wine farms sell wine/have restaurants and wine tasting which attracts tourists. ✓✓✓✓  

(12)  

[22]
Question 2

2.1 A site is the exact piece of land a settlement is found on. ✓ ✓ (2)

2.2 Available flat land ✓ ✓ / Natural harbour providing access to the ocean ✓ ✓ (4)

2.3 It has a harbour where the mode of transport changes, e.g from land to sea. ✓ ✓ (2)

2.4 a) Central Business District ✓ ✓ (2)
   b) Gridiron street pattern ✓ ✓ (2)
   c) Advantage: Easy to find your way ✓ ✓ / Easy to extend ✓ ✓ / Easy to subdivide ✓ ✓ (any 1)
      Disadvantage: Causes traffic congestion ✓ ✓ / Monotonous (boring) layout ✓ ✓ (any 1) (4)
   d) Tall buildings / Skyscrapers ✓ ✓ (2)
   e) Land is in demand so price increases ✓ ✓ / Cheaper to build upwards ✓ ✓ (any 1) (4)

2.5 All transport routes converge in the CBD. ✓ ✓ (2) [24]

Question 3

3.1 a) Sea Point – high income ✓ ✓; Malay Quarter – low income ✓ ✓ (4)
   b) Has sea view, which increases land value ✓ ✓ / On outskirts city; residents can afford transport costs ✓ ✓ (any 1) (4)

3.2 a) Informal settlement (squatter settlement) ✓ ✓ (2)
   b) Migrants are uneducated so they cannot find a job ✓ ✓
      They cannot afford rent or to buy a house ✓ ✓ (4)
   c) Family land not big enough to divide among children ✓ ✓ / Traditional farming methods so low food output ✓ ✓ / Inadequate services and facilities ✓ ✓ / Droughts and floods have greater impact ✓ ✓ / Farms workers evicted ✓ ✓ / Job losses due to increased mechanisation ✓ ✓ (any 2) (4)
   d) High degree of unemployment ✓ ✓ / Social problems, such as violence and crime, more common ✓ ✓ / Increase in litter and pollution ✓ ✓ / Waterborne diseases common ✓ ✓ / Increased spread of diseases ✓ ✓ (any 2) (4)
   e) Need to speak to community and find out their needs ✓ ✓ / Find out skills and talents in area ✓ ✓ / Need to set up industry in area based on local skills or raw materials or products ✓ ✓ / Improve farming methods of subsistence farmers ✓ ✓ / Possibly change to commercial cash crops ✓ ✓ / Small towns advertise attractions in their town ✓ ✓ / Find ways to attract tourists, for example lodges, casinos, holiday resorts, etc. ✓ ✓ / Develop or market the town as a commuter or retirement town ✓ ✓ / Petition government to maintain services and facilities ✓ ✓ (any 6 facts; include points for both rural areas and towns) (12) [34]
Answers to activity 3.7 (continued)

Question 4

4.1 a) Rural
   b) Metropolis
   c) Urban growth
   d) Natural, non-renewable resource
   e) Quaternary

4.2 a) – viii)
   b) – vii)
   c) – iii)
   d) – ii)
   e) – iv)

For more questions on urban settlement, refer to the following national Geography exam papers:

This chapter covers South Africa’s economic activities, as well as food security and globalisation. It also includes a section on water as this is a key resource for economic development in our country.
Key concepts

<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance of payment</td>
<td>A country's financial statement showing its transactions with the rest of the world</td>
</tr>
<tr>
<td>Balance of trade</td>
<td>The value of exports minus the value of imports</td>
</tr>
<tr>
<td>Bridge industries</td>
<td>Industries that are located between the source of raw materials and the customer, e.g. oil refineries</td>
</tr>
<tr>
<td>Centralisation</td>
<td>Movement of industries into core areas</td>
</tr>
<tr>
<td>Decentralisation</td>
<td>Movement of activities away from over-centralised areas</td>
</tr>
<tr>
<td>Economic activities</td>
<td>Activities that people practise to meet their needs</td>
</tr>
<tr>
<td>Exports</td>
<td>Goods and services that are sold to foreign countries</td>
</tr>
<tr>
<td>Favourable trade balance</td>
<td>Occurs when the value of exports is greater than the value of imports</td>
</tr>
<tr>
<td>Food insecurity</td>
<td>When not all the people have enough food to meet their needs for a healthy and productive life</td>
</tr>
<tr>
<td>Food security</td>
<td>When all the people have enough food to meet their needs for a healthy and productive life</td>
</tr>
<tr>
<td>Footloose industries</td>
<td>Industries that can be located in any place without being affected by factors such as resources or transport, e.g. diamond processing and computer chip manufacturing</td>
</tr>
<tr>
<td>Foreign exchange</td>
<td>The money paid to South Africa by other countries, e.g. dollars and pounds, in exchange for goods and services</td>
</tr>
<tr>
<td>Formal sector</td>
<td>Registered businesses that are licensed to sell goods or provide services</td>
</tr>
<tr>
<td>Globalisation</td>
<td>The way in which the economic, social, political and cultural activities of countries across the world are interconnected (working together)</td>
</tr>
<tr>
<td>Gross Domestic Product (GDP)</td>
<td>The total value of goods and services produced within the borders of the country in a year</td>
</tr>
<tr>
<td>Gross National Product (GNP)</td>
<td>The total value of goods and services produced by the permanent citizens of a country in one year (note that permanent citizens may work out of the country)</td>
</tr>
<tr>
<td>Hawker</td>
<td>An informal street trader</td>
</tr>
<tr>
<td>Imports</td>
<td>Goods and services that are bought from foreign countries</td>
</tr>
<tr>
<td>Industrial Development Zone (IDZ)</td>
<td>Industrial estates or areas aimed at economic growth and new investment; used by developing countries to attract investment, create jobs and boost exports</td>
</tr>
<tr>
<td>Informal sector</td>
<td>Activities by small, unregistered businesses that sell goods or provide services without being licensed, e.g. petty trade, casual employment, spaza shops and street hawkers or traders</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Transport network (roads, railways) and services (electricity, telecommunication, water and sewerage) that are in place</td>
</tr>
</tbody>
</table>

If you know and understand all the definitions of economic geography, you will be able to answer most of the questions in the economic geography section of the final exam. Use mobile notes to help you memorise these key concepts. Instructions for making them are on page x in this guide.
<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary activities</td>
<td>Activities that involve taking natural resources from the earth, e.g. farming (livestock, crops), forestry, mining, fishing</td>
</tr>
<tr>
<td>Quaternary activities</td>
<td>Activities that deal with information and research</td>
</tr>
<tr>
<td>Secondary activities</td>
<td>Activities that involve the processing of raw materials and manufacturing of goods, e.g. factories and industries</td>
</tr>
<tr>
<td>Semi-skilled worker</td>
<td>A worker who does routine tasks (simple tasks that are done on a regular basis); someone who is not skilled or trained to do specialised work (difficult tasks that need special training)</td>
</tr>
<tr>
<td>Skilled worker</td>
<td>A worker who has a specific set of skills or specialised knowledge that has usually been obtained through some kind of formal training</td>
</tr>
<tr>
<td>Spatial Development Initiatives (SDI)</td>
<td>Programme aimed at improving infrastructure and attracting business investments in rural areas that were neglected and underdeveloped</td>
</tr>
<tr>
<td>Tertiary activities</td>
<td>Activities that deal with the supply of services, e.g. banking, trade and transport</td>
</tr>
<tr>
<td>Trade</td>
<td>The flow of goods and services from producers to consumers across the world</td>
</tr>
<tr>
<td>Trading bloc</td>
<td>A group of countries that have common markets or trade agreements</td>
</tr>
<tr>
<td>Unskilled worker</td>
<td>A worker who performs simple duties that do not require any specific skills, training or previous experience; usually involves hard physical labour</td>
</tr>
</tbody>
</table>

In an exam you may be asked to test your understanding of terms by matching the key concept with the definitions provided. An example of this kind of question is provided in activity 4.1 on page 95. Practise this by completing the activity.

**Note**

Take care not to confuse the terms **gross domestic product (GDP)** and **gross national product (GNP)** with one another.

**GDP** refers to the total value of goods and services produced within the borders of South Africa.

**GNP** refers to the total value of goods and services produced by the permanent citizens of a country (even if they live and work in another country).
Activity 4.1

Choose a term from Column B that matches a statement in Column A. Write only the letter (A to F) next to the question number (1 to 5), for example 6 – G.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Obtaining raw materials from the earth</td>
<td>A. Gross domestic product</td>
</tr>
<tr>
<td>2. Total value of goods and services produced by the permanent citizens of a country in one year</td>
<td>B. Tertiary activity</td>
</tr>
<tr>
<td>3. Provision of services</td>
<td>C. Gross national product</td>
</tr>
<tr>
<td>4. Processing of raw materials</td>
<td>D. Primary activities</td>
</tr>
<tr>
<td>5. Value of all goods and services produced in a country in one year</td>
<td>E. Economic activities</td>
</tr>
<tr>
<td></td>
<td>F. Secondary activities</td>
</tr>
</tbody>
</table>

Answers to activity 4.1

1. D (Primary activities) ✓ ✓ (2)
2. C (Gross National Product) ✓ ✓ (2)
3. B (Tertiary activities) ✓ ✓ (2)
4. F (Secondary activities) ✓ ✓ (2)
5. A (Gross Domestic Product) ✓ ✓ (2)

In the next section we focus on primary, secondary and tertiary economic activities. These economic activities are important to the economy and the country’s development, and are interdependent. Primary activities stimulate secondary activities which, in turn, stimulate job creation in the tertiary sector.
4.1 Primary economic activities

Primary activities involve extracting (removing) raw materials from the earth, for example farming, fishing, forestry and mining. We focus on farming and mining as they are the two primary activities that contribute the most to South Africa’s economy.

4.1.1 Farming in South Africa

In this section we focus on factors that favour and hinder farming. There are different types of farming: crop farming, stock farming and mixed farming (both crop and stock). The word ‘agriculture’ is used to refer to all types of farming.

4.1.1A Factors favouring farming

These factors make farming more productive and profitable:

- There is a high demand (market) for farming products so farmers sell their crops more easily. A farmer’s profits rise when they can sell for a higher price to overseas markets with a demand for their crops or stock.
- The fertile floodplains of rivers allow farmers to produce more crops or grazing land (pastures) in these areas. This supports farming and increases profits.
- The eastern half of the country gets more than 500 mm of rain a year. This makes it possible to produce more crops and ensures greener pastures for stock farming, therefore increasing profits.
- The relatively high summer temperatures help crops to grow and increases crop production. It also ensures greener pastures for stock farming.

Use the following word mnemonic to help you remember the factors that favour farming in South Africa:

- **F = Fertility** → Farmer
- **D = Demand** → Daniel
- **R = Rain** → Reaps
- **T = Temperatures** → Tomatoes

4.1.1B Factors hindering farming

These factors make farming difficult and therefore less productive and less profitable:

- Rainfall is low and unreliable on the plateau, which limits crop production and decreases available pastures for stock farming.
- Soil erosion due to incorrect farming methods increases farming costs and decreases profits.
- Natural hazards such as droughts, floods and hail storms damage crops and stock and decrease production and profits.
- HIV and AIDS have a negative impact on the health and productivity of farm workers.
- Price fluctuations (when prices go up and down) make it difficult for farmers to stay in business and make a profit.
- Pests which affect crops and stock are costly to control and cause a decrease in production and profits.

Use the following word mnemonic to help you remember the factors that hinder farming in South Africa:

- **H = Hazards** → Hungry
- **P = Price** → People
- **S = Soil** → Seek
- **H = Health** → Healthy
- **R = Rainfall** → Round
- **P = Pests** → Potatoes
4.1.1C Importance of farming in South Africa

Farming benefits the economy and people in these ways:
- Farming provides jobs to people and so decreases unemployment.
- Farming provides food to the country so less food needs to be imported. Food that is supplied locally is less expensive than imported food.
- Farming equipment is expensive because much of it is imported, but South Africa has reduced these costs by manufacturing some equipment locally, for example irrigation systems.
- Farming involves moving crops to the markets, which in turn leads to improving the country's infrastructure (roads, railways and communication systems).
- South African farming products are exported to other countries earning us foreign exchange. This improves the country's economy.

4.1.1D Food security and insecurity

Food security is when all the people have enough food to meet their needs for a healthy and productive life. Some of the factors (reasons) why people have enough food (food security) are:
- Commercial farms are able to produce enough food due to favourable climatic factors.
- People can afford to buy the food. In other words, farmers have a market.
- The need to import food from other countries at high costs is reduced because food is grown locally.
- Genetically modified crops are more resistant to diseases, pests and viruses so more crops can be produced.

Food insecurity is when not all the people have enough food to meet their needs for a healthy and productive life. Food insecurity affects poor people, many of whom live in rural areas. These people try to survive by growing their own food. This is called subsistence farming. This type of farming provides only enough food for the farmer's own family.

Some of the factors (reasons) for why people do not have enough food (food insecurity) are:
- There is a lack of fertile (arable) land on which to grow food.
- Climate change increases natural disasters (droughts and floods) that damage crops.
- When you are poor it is more difficult to buy the things you need to farm, such as enough land, equipment, seeds and irrigation systems.
- Subsistence farmers are often uneducated about ways to improve crop production so land is often overused for crops or overgrazed by cattle.

Some of the measures (ways) to prevent food insecurity are:
- Prevent soil erosion by practising better farming methods, for example crop rotation or rotational grazing (putting cattle in different fields or camps).
- Use efficient ways of storing food, especially when more crops are produced in high-rainfall seasons.
- Improve ways of storing and using water supplies to reduce water wastage.
Activity 4.2

The cartoon in Figure 4.1 below shows how environmental problems can affect food security.

Wake up, people! Many **environmental problems** threaten our food security...

Like overfishing...

Each individual fisherman wants to maximise his profit, but too much fishing can destroy the fishery for everyone.

Out of the way, there’s profit to be made!

Unfortunately, they are not going to like rising sea levels.

And climate change... I like cheap electricity!

I like cheap petrol!

I like cheap fertilisers!

1. How has the use of fossil fuels and fertilisers caused climate change? (3 × 2 = 6)
2. How does climate change link to rising sea levels? (2 × 2 = 4)
3. How would rising sea levels affect food security? (1 × 2 = 2)
4. Explain your answer in question 3. (1 × 2 = 2)
5. Name another factor in the cartoon that would affect food security. (1 × 2 = 2)

Figure 4.1: Factors contributing to food insecurity

Exams

For more questions on **food security** and **agriculture**, refer to the following national Geography exam papers:


Answers to activity 4.2

1. Fossil fuels and fertilisers release greenhouse gases like carbon dioxide and methane into the air ✓✓. These gases trap heat in the atmosphere ✓✓. This increases the Earth’s temperature, which leads to changes in Earth’s climate and weather. ✓✓ (6)
2. The increase in the Earth’s temperature causes the polar icecaps to melt ✓✓. This leads to increasing sea levels. ✓✓ (4)
3. It would decrease food security/cause food insecurity. ✓✓ (2)
4. Land would be flooded, so there is less land to use for agriculture or food production. ✓✓ (2)
5. Overfishing ✓✓ (2)
4.1.2 Mining in South Africa

In this section we focus on factors favouring and hindering mining. There are different types of mining: open cast and shaft mining.

4.1.2A Factors favouring mining

These factors make mining more productive and profitable:

• South Africa has many different minerals which can be mined and used in factories or exported so the country earns foreign exchange.
• South African mines benefit from having lots of local unskilled labour. This results in lower labour costs and therefore higher profits.
• Foreign skilled miners come to work in South African mines and the mines benefit from their knowledge and skills.
• Many countries invested money in our mines, which assisted with further development of the mines and a lowering of costs.
• A well-developed infrastructure (roads and railway lines, water and electricity) assists mines to do business.

4.1.2B Factors hindering mining

These factors make mining less productive and less profitable:

• The high temperatures in some underground mines create difficult working conditions and this decreases productivity.
• Large distances between the mines and the harbours or towns increase the cost of transporting the minerals to the markets.
• There are high costs involved in training and housing mine workers.
• Mine worker strikes decrease productivity and profits.
• Water shortages and underground flooding of mines are a serious problem. It is expensive to fix the problem and this decreases profits.
• Ensuring safety on the mines is costly, especially when tunnel roofs collapse.

4.1.2C The importance of mining to the South African economy

Mining benefits the economy and people in these ways:

• The mining sector provides many jobs, which decreases unemployment.
• Mines supply raw materials to secondary activities such as factories and industries. This in turn stimulates industrial development.
• When mines start up, new towns and transport networks develop around the mines.
• Mining stimulates other sectors of the economy, such as farming, building and trade, to meet the needs of the growing number of people who live and work in mining towns.
• Harbours, like those at Saldanha Bay (Western Cape) and Richards Bay (KwaZulu-Natal), expand (grow bigger) to cope with increased mineral exports to other countries. This creates more jobs and also helps other sectors of the economy to grow.
• The export of mining products increases the profits of the mines because they earn foreign exchange.
4.1.2D Impact of mining on the environment

The processes involved in removing minerals from the earth create waste products and have a negative effect on the environment. Some of the negative effects of mining are:

- The natural vegetation is removed to clear the ground for mining activities. This leads to an increase in soil erosion in these areas.
- When vegetation is removed it destroys natural habitats and damages ecosystems, which can lead to the extinction of plants and animals in the area.
- The land is destroyed when mine dumps and slimes dams are built to store waste.
- Chemicals that leach (wash off) from the mine dumps when it rains cause water and land pollution.
- Sinkholes are a danger in areas where mining takes place.
- Coal is a major mining product in South Africa. Power stations burn coal to make electricity. The carbon dioxide that is released during this process contributes to global warming and climate change.

4.2 Secondary economic activities

Secondary activities involve the processing of raw materials and manufacturing of goods. We use the word ‘industries’ for secondary activities. For example, sugar cane is turned into sugar at an industry called a sugar refinery; trees are turned into wood shavings and then paper at an industry called a sawmill; cowhides are turned into leather to make handbags and shoes at an industry called a tannery.

Secondary activities can be divided into heavy and light industries. Learn the information in Table 4.1 below to understand the differences between these two types of industries.

<table>
<thead>
<tr>
<th></th>
<th>Light industry</th>
<th>Heavy industry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example</strong></td>
<td>Jewellery making, clothes factory, computer manufacturer</td>
<td>Power stations, iron and steel factory, motor vehicle factory, paper mill</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>In a city in the CBD; in the zone of decay; in an industrial estate</td>
<td>On the outskirts of a city; in rural areas near the raw material source</td>
</tr>
<tr>
<td><strong>Raw material</strong></td>
<td>Small, may be partially processed</td>
<td>Large, bulk, not processed</td>
</tr>
<tr>
<td><strong>Land requirements</strong></td>
<td>No specific needs, may be in a multi-storey building</td>
<td>Needs large area of flat land, single-storey buildings</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td>Uses existing road network and local power supply</td>
<td>Needs access to major roads or railways, water supply and power supply</td>
</tr>
<tr>
<td><strong>Environmental impact</strong></td>
<td>Has little to no impact on surrounding area</td>
<td>Utilises a large amount of water and causes air and noise pollution</td>
</tr>
</tbody>
</table>

Table 4.1: The differences between heavy and light industries
In the next sections we focus on factors that affect the location of industries and the factors that favour or hinder the development of secondary economic activity. We look at the development of the four main industrial regions in South Africa:

- Pretoria–Witwatersrand–Vereeniging complex (PWV)
- Durban–Pinetown
- Port Elizabeth–Uitenhage
- Southwestern Cape

### 4.2.1 Industrial development in South Africa

The availability of raw materials in South Africa has led to the development of large industries (factories) that process the raw materials or use semi-finished products to manufacture final products.

#### 4.2.1A Factors affecting the location of an industry

When deciding where to build an industry, the following two factors are the most important:

- **Raw materials**: How close are the natural resources or raw materials the industry needs to make its product?
- **Markets**: How close is the industry to where it sells its product? In other words, how close are the consumers (the people that buy the product)?

An industry will locate itself close to either the raw materials or the market. If the raw material is large and difficult to transport, the industry will locate close to the raw material. This industry would be called **raw-material orientated**.

If the raw material is smaller and easier to transport, the industry will locate close to the market. The industry would be called **market orientated**.

The following factors can also affect the location of an industry:

- **Transport**: Access to major transport routes between the industry, the raw material source and the market.
- **Energy**: A reliable supply of electricity is needed to be able to process raw materials or manufacture goods.
- **Labour**: A skilled and unskilled work force must live in the area where the industry is located.
- **Link industries**: These are industries that you sell your product to. How close the industry is to its link industries will affect its transport costs.
- **Government policies**: Government may offer subsidies or tax incentives to industries that locate in certain areas, which may help to decrease costs.
4.2.1B Factors favouring industrial development in South Africa

These factors make industries more productive and more profitable:
- South Africa has a wide range of industries because there is a wide range of raw materials to support production.
- A well-developed infrastructure (roads and railway lines, water and electricity) assists industries to do business.
- The availability of cheap, level (flat) land makes it cheaper to develop industries in South Africa.
- The availability of a large skilled and unskilled labour force in the areas where industries are located decreases the costs of training and worker accommodation and transport.

4.2.1C Factors hindering (restricting) industrial development in South Africa

These factors make industries less productive and less profitable:
- The large distances between South Africa and its foreign markets increases transport costs and makes it more difficult to compete with industries in those countries.
- There is a shortage of skilled labour in South Africa. This increases labour costs because industries have to attract foreign skilled labour and pay high salaries to retain skilled workers.
- Labour strikes decrease the productivity of industries in South Africa and this increases costs and limits further industrial development.
- Water and electricity shortages and price increases limit further industrial development.

4.2.1D Main industrial regions in South Africa

Figure 4.2 on page 103 shows the four main industrial regions in South Africa.
Figure 4.2: South Africa’s four industrial regions

1. PWV (Gauteng)
   - This is the largest industrial region in South Africa.
   - Factors favouring industries:
     - Large markets
     - Plenty skilled and unskilled labour
     - Many different kinds of raw materials
     - Well-developed transport routes
     - Access to money (capital from banks and investors)
   - Kinds of industries:
     - Chemical factories
     - Iron and steel factories
     - Food and drink (beverages) factories

2. Port Elizabeth–Uitenhage
   - This is the second largest industrial region in South Africa.
   - Factors favouring industries:
     - Access to a shipping port
     - Large markets
     - Plenty skilled and unskilled labour
     - Many different kinds of raw materials
     - Well-developed transport routes
     - Access to money (capital from banks and investors)
   - Kinds of industries:
     - Food processing factories
     - Sugar refining (making sugar from sugar cane)
     - Motor manufacturing
     - Oil refining (making petrol from crude oil)
     - Chemical factories

3. Port Elizabeth–Uitenhage
   - This is the fourth largest industrial region in South Africa.
   - Factors favouring industries:
     - Access to a shipping port
     - Factories have been here for a long time due to historical reasons, such as the arrival of the early settlers
     - Plenty skilled and unskilled labour
     - Availability of farming products
   - Kinds of industries:
     - Motor vehicle factories
     - Leather goods factories
     - Textiles factories
     - Fish canning and packing factories
     - Wine making

4. Southwestern Cape
   - This is the third largest industrial region in South Africa.
   - Factors favouring industries:
     - Access to a shipping port
     - Factories have been here for a long time due to historical reasons, such as the arrival of the early settlers
     - Plenty skilled and unskilled labour
     - Availability of farming products
   - Kinds of industries:
     - Clothing and footwear factories
     - Food processing factories
     - Fish canning and packing factories
     - Wine making

5. Durban–Pinetown
   - This is the fourth largest industrial region in South Africa.
   - Factors favouring industries:
     - Access to a shipping port
     - Factories have been here for a long time due to historical reasons, such as the arrival of the early settlers
     - Plenty skilled and unskilled labour
     - Availability of farming products
   - Kinds of industries:
     - Clothing and footwear factories
     - Food processing factories
     - Fish canning and packing factories
     - Wine making
Activity 4.3

Choose a term from the box that matches the descriptions that follow.

heavy industries; footloose industries; market-orientated industries; centralisation; decentralisation; Durban–Pinetown; Gauteng/Pretoria–Witwatersrand–Vereeniging

1. Over-concentration of industries in a few core areas
2. The largest industrial core area in South Africa
3. Industries that can locate anywhere due to improved technology
4. Industries that must be close to the consumers
5. These industries are associated with high noise and air pollution

\[5 \times 2 = 10\]

Answers to activity 4.3

1. Centralisation ✓✓ (2)
2. Gauteng/Pretoria–Witwatersrand–Vereeniging ✓✓ (2)
3. Footloose industries ✓✓ (2)
4. Market-orientated industries ✓✓ (2)
5. Heavy industries ✓✓ (2)

[10]

Exams

For more questions on industrial regions, refer to the following past national Geography papers:

4.3 Tertiary economic activities

Tertiary economic activities involve the selling of goods and provision of services. For example, the selling of goods would include any supermarket, car dealer or clothes shop. Examples of services are hairdressers, doctors, internet cafes, and repair and maintenance companies.

Tertiary economic activities are divided into the formal sector and informal sector. In this section we will focus on the informal sector in South Africa, its characteristics and the reasons for its development. We will also look at the challenges facing this sector and how the informal sector can be improved.

4.3.1 The informal sector in South Africa

Examples of people who work in the informal sector are hawksers, parking guards and casual labourers (painters, tilers, gardeners, cleaning staff).

4.3.1A Characteristics of the informal sector

The informal sector has the following characteristics:

• Workers are self-employed.
• Women and children are mainly involved in this sector.
• It is associated with casual labour.
• It employs unskilled or semi-skilled workers.

4.3.1B Importance of the informal sector

The informal sector benefits the economy and people in the following ways:

• It provides an income to many people and decreases unemployment.
• Informal traders are more accessible to working class consumers.
• Consumers can buy goods in smaller quantities and at a lower price.
• It provides opportunities for people to grow and apply their entrepreneurial skills.

4.3.1C Reasons for the development of the informal sector

• Large scale job losses in the formal sector increases the number of people who make work for themselves in the informal sector.
• Greater mechanisation (use of machinery) on farms and in industry results in more workers being unemployed and needing to make work for themselves in the informal sector.
• People who lack formal qualifications are less likely to be employed in the formal sector, causing them to make work for themselves in the informal sector.
• Immigrants who are not able to find legal employment in the formal sector turn to the informal sector to make an income.
4.3.1D Problems or challenges facing the informal sector

These factors make informal trading less productive and less profitable:
- Traders are frequently harassed by local authorities.
- Traders do not have access to proper trading facilities.
- Traders and their goods are exposed to the weather.
- Banks do not like to give loans to informal traders.
- The sector is unpredictable and the income unreliable.

4.3.1E Measures to improve the informal sector

These are some of the things that can be done to help informal traders:
- Local authorities can provide specific areas for informal trading.
- Local authorities can provide infrastructure, such as hawker stalls.
- Banks can make access to bank loans easier.
- Local authorities can provide training to teach people the necessary skills to develop their businesses.

4.4 Quaternary economic activities

Quaternary economic activities deal with communication, technology and research. Examples of quaternary activities are new product development, medical research, customer surveys and market research, call centres, Facebook, Google and other information age businesses.

4.5 Globalisation

Globalisation refers to the way in which the economic, social, political and cultural activities of countries across the world are interconnected (linked together). The development of information and communication technology, and transport infrastructures via air, land and sea, has led to the following:
- The ability to instantly (quickly) communicate with people or spread information across the globe
- Faster and easier travel between countries
- An increase in the amount of goods and services that are traded
- Access to skilled and cheap labour in other countries, resulting in increased competitiveness in markets
- A shift in where goods and services are produced – parts of the production process may be moved to other countries to benefit from cheap or skilled labour or cheap raw materials
- The development and growth of multinational corporations

4.5.1 Multinational corporations

These are large companies with factories, branches or offices that operate (work) in several countries. In other words, multinational corporations are companies that manufacture and sell their goods on a worldwide scale.

Examples of multinational corporations are Microsoft, Intel, Nokia, Samsung, Sony, LG, Toyota, Volkswagen, Shell, Engen, Nike, Reebok, etc.
Multinational corporations have the following characteristics:

- The company headquarters are located in the more economically developed countries (MEDCs). These MEDC countries are also called developed countries.
- The factories and branches are located in less economically developed countries (LEDCs). These LEDC countries are also called developing countries.

The advantages of setting up multinational corporations in LEDCs are:

- **Job creation**: Jobs are created in the multinational corporation factories and offices, which stimulates the economy of the developing countries.
- **Skills transfer**: Local people are trained and skills are transferred to people in the developing countries.
- **Pace of development increases**: Development is speeded up due to direct foreign investment in the developing countries.
- **Technology and communication networks** improve in the developing countries.

The disadvantages of locating multinational corporations in LEDCs are:

- **Employment insecurity**: Local factories cannot compete with the low prices of multinational companies and are forced to close down. This causes people who work in local factories to lose their jobs in the developing country.
- **Exploitation of workers**: People who work in the multinational factories and offices based in the developing country are exploited. They are paid low wages and work long hours. They are often forced to work in poor working conditions that are harmful to their health.
- **Loss of profits**: The multinational corporations take the profits they make out of the developing country to the developed country. So, the profits move out of the LEDC to the MEDC. Because the money is not reinvested in the LEDC, the developing country stays poor.

In an exam, you may be asked to define a multinational corporation and give examples of these corporations. You may also be asked to state the advantages and disadvantages of multinational corporations for a developing country.
### Activity 4.4

Choose a description from Column B that matches a term in Column A. Write only the letter (A-L) next to the question number (1-10), e.g. 11.L

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Trade</td>
<td>A. Groups of countries that have common markets or trade agreements</td>
</tr>
<tr>
<td>2. Import</td>
<td>B. Industrial estates aimed at economic growth and new investment</td>
</tr>
<tr>
<td>3. Decentralisation</td>
<td>C. Buying and selling of goods and services</td>
</tr>
<tr>
<td>4. Trading blocs</td>
<td>D. Movement of activities away from over-centralised areas</td>
</tr>
<tr>
<td>5. Industrial Development Zones</td>
<td>E. Commodity brought into a country</td>
</tr>
<tr>
<td>6. Informal sector</td>
<td>F. Movement of industries into core areas</td>
</tr>
<tr>
<td>7. MEDCs</td>
<td>G. The way in which activities of countries across the world are interconnected</td>
</tr>
<tr>
<td>8. Multinational corporation</td>
<td>H. Countries that are less developed in the world</td>
</tr>
<tr>
<td>9. LEDCs</td>
<td>I. The trade involving businesses not registered with the government and occupying premises illegally</td>
</tr>
<tr>
<td>10. Globalisation</td>
<td>J. Company that has factories, offices or shops in different countries</td>
</tr>
</tbody>
</table>

### Answers to activity 4.4

1. C ✓✓
2. E ✓✓
3. D ✓✓
4. A ✓✓
5. B ✓✓
6. I ✓✓
7. K ✓✓
8. J ✓✓
9. H ✓✓
10. G ✓✓

(10 × 2 = 20)
4.6 Water as a critical resource in South Africa

Water is a key resource for economic development in South Africa. However, there is not enough water in South Africa to meet the needs of the growing population. It is important that we plan ahead to make sure that we save and store water. This will ensure a reliable and continuous water supply for the future.

4.6.1 Reasons for water shortages in South Africa

South Africa is generally a very dry country, because it is located in a semi-arid part of the world. A semi-arid area has the following characteristics:

- **Low rainfall**: South Africa has a very low rainfall. The average rainfall is around 450 mm per annum (per year). This is far less than the average rainfall for the world which is 800 mm per annum.
- **Unreliable rainfall**: South Africa’s rainfall is also unreliable. In other words, it does not occur at the same time every year.
- **Non-perennial rivers**: A low rainfall causes most of South African rivers to be non-perennial (they only flow in the rainy season).
- **High temperatures and high evaporation rates**: Semi-arid areas have high temperatures, which causes high evaporation rates. This results in water being lost through evaporation. This is a problem when dams are not properly planned and built. For example, the Vaal Dam is a poorly planned dam because it is very wide and shallow and built in a warm area, so it loses a lot of water through evaporation. The Sterkfontein Dam is a well-planned dam because it is very deep and narrow and in a cool place, so it does not lose as much water through evaporation.
- **Uneven rainfall distribution**: South Africa’s low rainfall is also not evenly spread across the country. This limits development in areas with low rainfall. It also increases the cost of developing these areas as water needs to be piped to the area.

Figure 4.3 below shows the uneven rainfall distribution across South Africa.

![Rainfall distribution across South Africa](image)

**Figure 4.3: Rainfall distribution across South Africa**
4.6.2 Methods of improving the water supply in South Africa

There are different methods (ways) of improving the water supply in South Africa. In this section we focus on the following two methods:

- The building of dams
- Water transfer schemes or projects, in particular the Tugela–Vaal Project, Orange River project and the Lesotho Highlands project

4.6.2A Building dams

Dams are built for two reasons:

- To store water (this will be discussed later in this chapter)
- For flood control (the dams hold the extra water from rainfall and runoff from rivers, to prevent the flooding of areas below the dam)

A dam wall acts as a barrier that holds water in a river back and raises the river’s water level. To make a dam, a wall is constructed (built) across a river from one side of the river to the other side. Water will collect upstream (above the dam wall) while the river continues to flow downstream (below the dam wall). The river continues to flow downstream because a dam wall can release water through openings called sluice gates. Once a dam has filled up, the river can receive a steady supply of water all year long because water can be regularly released through the sluice gates by the dam’s management staff.

Figure 4.4A to C below shows the stages in the building of a dam wall in order to allow water to collect on one side forming a dam.

Figure 4.4: Stages in the building of a dam wall
Figure 4.5 shows the Katse dam wall. The dam is visible behind the wall as is the river flowing downstream out of the dam. The Katse Dam is part of the Lesotho Highlands water transfer scheme discussed later in this chapter.

Building dams has the following **advantages:**

- A dam allows for a more permanent (perennial) flow of water in the river below. This ensures a constant water supply for towns and farms in the area.
- A dam increases the supply of water for agricultural, municipal and industrial use.
- A dam can be used to generate electricity. This is called hydroelectricity (a process that uses the force of water to generate energy to make electricity). Hydroelectricity is a renewable energy source that replaces energy produced by coal-burning power stations.
- A dam offers people fun recreational facilities such as swimming, water-skiing, boating, angling (fishing), picnic areas and camping sites.

Building dams has the following **disadvantages:**

- When dams are built, large areas of land need to be flooded to make the dam. This leads to the following disadvantages:
  - The natural ecosystem is destroyed when the large area of land is flooded.
  - People who were living in the immediate area of the dam have to be moved off their land before the dam is built.
  - Dams collect large volumes of water. This means that the amount of water lost through evaporation increases.
4.6.2B Water transfer schemes

A water transfer scheme is when water is transferred from one area to another. Water is taken from an area with a lot of water and transferred to an area in need of water. In order to transfer water, it needs to be stored in dams and then transferred in canals or tunnels. A canal is a large gutter lined with concrete in which water flows above the ground. A concrete tunnel is used when water needs to be transferred over longer distances, often underground below a mountain. There are three main water transfer schemes in South Africa:

- The Orange River project
- The Tugela–Vaal project
- The Lesotho Highlands project

Example 1: Orange River project

The Orange River project is a water transfer scheme supplying water to the Eastern Cape.

Description of the Orange River project

- Water from the Orange River is stored in the Gariep Dam.
- From there it is transported in the Orange–Fish Tunnel to the Fish River.
- It then flows down the Fish River to East London on the Indian Ocean coast.
- Water can also be transported from the Fish River through the Fish–Sundays Tunnel to the Sundays River.
- It then flows down the Sundays River to Port Elizabeth on the Indian Ocean coast.
- Both the Fish and Sundays Rivers supply water to many Eastern Cape farms.

Benefits of the Orange River project

- Improved crop production due to improved water supply for irrigation
- Improved flood control due to the building of the Gariep Dam
- Improved power supply because hydroelectricity is generated
- Increased tourism to the area due to the recreational activities available at the Gariep Dam
- Municipalities have improved water supply for domestic (household) use
- Greater water supply led to an increase in industrial development in Port Elizabeth and East London.

Figure 4.6 on page 114 shows a plan view of the Orange River water transfer scheme.
Example 2: Tugela–Vaal project

The Tugela–Vaal project transfers water from KwaZulu-Natal to Gauteng and surrounding farming and mining areas.

Description of the Tugela–Vaal project

- Water is transferred from the Tugela River on the eastern side of the escarpment through various canals into the Kilburn Dam.
- It is then pumped from the Kilburn Dam into the Driekloof Dam.
- In order for the water to reach the Driekloof Dam it needs to be pumped underground into a massive tunnel pushing the water up through the escarpment into the Driekloof Dam at the top of the escarpment.
- The water is then released from the Driekloof Dam into the Sterkfontein Dam and into the Wilge River and the Vaal River.
**Benefits of the Tugela–Vaal project**
- Improves the water supply to Gauteng’s population, factories, mines and surrounding farms
- Improved farm production due to improved water supply for irrigation
- Improved power supply because hydroelectricity is generated
- Promotes tourism due to more recreational activities being available at the Sterkfontein Dam

Figure 4.7 shows a plan view of the Tugela–Vaal water transfer scheme. Figure 4.8 shows a cross section through the Tugela–Vaal water transfer scheme.

*Figure 4.7: Plan view of the Tugela–Vaal water transfer scheme*

*Figure 4.8: Cross section through the Tugela–Vaal water transfer scheme*
Example 3: Lesotho Highlands project

The Lesotho Highlands project is a water transfer scheme which transfers water from Lesotho to Gauteng, and surrounding farming and mining areas.

**Description of the Lesotho Highlands project**
- Water from the tributaries of the Orange River in Lesotho are stored in the Katse Dam and well as the Muela and Mohale dams.
- The largest dam in this project is the Katse Dam.
- The water is then transferred from these dams through the Maluti Mountains in a tunnel which flows out from the mountains at the Ash River outflow point near Clarens in the Free State.
- The water then flows into the Liebenberg Vlei near Bethlehem, and then into the Wilge River and the Vaal River in the Free State.

**Benefits of the Lesotho Highlands project**

The benefits of the Lesotho Highlands water project are shared between Lesotho and South Africa. Both countries benefit from improved water and electricity supply. The specific benefits to each country are as follows:

**Benefits for Lesotho:**
- Improved water supply for irrigation leads to improved farm production, which in turn increases food security.
- The building of the water transfer scheme has led to an improved road network in Lesotho.
- Improved electricity supply has led to an increase in industrial development in Lesotho.
- Improved industrial development leads to job creation in Lesotho, which improves the standard of living of the population.

**Benefits for South Africa:**
- Improved water supply to Gauteng's population, factories, mines and surrounding farms
- Improved farm production due to improved water supply for irrigation.
Figure 4.9 shows a plan view of the Lesotho Highlands water transfer scheme.

4.6.3 Sustainable use and management of water

The water transfer schemes can only go so far to ensure a reliable and continuous supply of water. We also need to play our part to save water and manage it properly.

The role of government is very important. The Department of Water Affairs and Forestry (DWAF) is responsible for managing water in our country. These are some of the actions that DWAF takes to manage water:

- Increasing the price of water during a drought
- Recycling and re-using industrial water
- Monitoring and enforcing laws to control industrial use of water and waste water treatment
- Running public awareness programmes to teach people how to save water

Here are a few hints to save water:

- Do not leave taps running
- Fix leaking taps
- Bath or shower for a short time
- Use bath and basin water to water gardens
- Use a bucket to wash your car (not a hosepipe)
- Can you add more hints to the list?

For questions on water as a critical resource, refer to the following past national Geography papers:

- Geography Paper 1 November 2011 Paper 1 – Question 4.6, on page 12.
- Geography Paper 1 February/March 2012 – Question 3.6, on page 10.
4.6 Understanding graphs and tables

In the exam, economic concepts are often tested using tables or graphs. It is important that you understand how to get information from a graph or table to answer such questions.

When a question in the exam refers to a table or graph, it is important that you study the table or graph before you read the questions. This is similar to reading a comprehension text before answering the questions. You will need to UNDERSTAND the table or graph in order to answer the questions.

4.6.1 Understanding graphs

In this section we look at two types of graphs: bar graphs and pie charts. Follow these steps when you read a graph:

Steps to reading a bar graph

Step 1: Look at the heading for the graph – this will tell you what the graph shows. The heading tells you what is being compared. It will tell you how the two or more factors shown on the graph are connected. In other words, it will tell you what the relationship is between the factors shown.

Step 2: Next look at the labels on the different axes to see what factors are being compared on the graph. These should be the same factors mentioned in the heading.

Step 3: Look at the units of measurement on the different axes, for example percentage and time, or amount of money compared across economic sectors.

Step 4: Look at what is being compared and how the factors affect one another. In other words, try and understand the relationship between the different factors. For example, as the one factor increases so the other factor may decrease, or as one factor increases so the other factor may stay the same.
Step 5: Look for anything that is unusual on the graph. See if there is anything that does not fit the relationship between the factors. In other words, if the relationship shown is that one factor increases and all the other factors except for one factor decrease, we will have something to say about the exception. For example, on a graph it could be shown that the contribution of primary economic activities increased production over time, except for mining whose production decreased.

Step 6: Now read the questions set. Circle the question word to understand what is asked. Set about answering the questions. You will find the answers by reading the information in the graph.

4.6.1 Example of a bar graph
Carefully study the bar graph in Figure 4.10 below which shows the contribution of different economic sectors to South Africa’s GDP (Gross Domestic Product).

The contribution of various industries to GDP (1995 and 2002)

<table>
<thead>
<tr>
<th>Industry</th>
<th>1995</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>21.1</td>
<td>20.2</td>
</tr>
<tr>
<td>Finance</td>
<td>10.3</td>
<td>10.3</td>
</tr>
<tr>
<td>Government services</td>
<td>10.6</td>
<td>10.5</td>
</tr>
<tr>
<td>Trade</td>
<td>10.2</td>
<td>10.7</td>
</tr>
<tr>
<td>Transport</td>
<td>9.1</td>
<td>7.5</td>
</tr>
<tr>
<td>Mining</td>
<td>7.0</td>
<td>6.4</td>
</tr>
<tr>
<td>Agriculture</td>
<td>3.3</td>
<td>2.4</td>
</tr>
<tr>
<td>Electricity</td>
<td>3.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Construction</td>
<td>3.3</td>
<td>2.8</td>
</tr>
<tr>
<td>Other producers</td>
<td>2.8</td>
<td>3.2</td>
</tr>
<tr>
<td>Community</td>
<td>2.7</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Figure 4.10: Example of a bar graph

Follow these steps to read the graph

1. The heading – the graph shows GDP (factor 1) in relation to different industries (factor 2), and time (factor 3).
2. The axes – the vertical axis shows factor 1 (the GDP). The horizontal axis shows factor 2 (different industries) and factor 3 (time).
3. Units of measurement – on the vertical axis factor 1 (GDP) is shown as a percentage of total GDP. The horizontal axis lists factor 2 (industries) by name and factor 3 (time) in years.
4. Look at how the GDP goes up or down from 1995 to 2002 in each industry. For example, manufacturing goes down from 1995 to 2002. The amount it decreases is calculated by subtracting the lower amount from the higher amount: 21.2% – 20.2% = 1%.
5. Look at what is unusual – the contribution of finance and transport is much higher in 2002.
6. Now read the questions in activity 4.5 on page 121.
Activity 4.5

The following questions refer to the graph in Figure 4.10 on page 120.
1. What do the letters GDP stand for? (1 × 2 = 2)
2. Which industry contributes the most to the GDP? (1 × 2 = 2)
3. What economic activity do mining and agriculture belong to? (1 × 2 = 2)
4. Mining and agriculture contribute less to the GDP than manufacturing, which is a secondary activity. Explain the reason for this observation. (2 × 2 = 4)
5. The contribution of transport to the GDP increased from 1995 to 2002. Give a possible reason for this. (1 × 2 = 2)

Answers to activity 4.5
1. Gross domestic product. ✓ ✓ (2)
2. Manufacturing ✓ ✓ (2)
3. Primary ✓ ✓ (2)
4. Mining and agriculture produce raw materials which are sold for less money than processed goods sold by manufacturing industries. ✓ ✓ (2)
5. Increased government spending on infrastructure development ✓ / ✓ / Increased use of public transport generating more revenue for the state. More purchase and use of private vehicles. ✓ ✓ (2)

4.6.B Example of a pie chart
Carefully study the pie chart or pie graph below (Figure 4.11) illustrating the contribution of different provinces to the national GDP.

[Pie chart image: Eastern Cape 8.1%, Free State 5.5%, Gauteng 33.3%, KwaZulu-Natal 16.7%, Limpopo 6.7%, Mpumalanga 6.8%, Northern Cape 2.2%, North West 6.3%, Western Cape 14.4%]

Figure 4.11: Contribution of different provinces to the national GDP
Follow the steps to read the graph

1. The heading – the graph shows GDP (factor 1) in relation to different provinces (factor 2).
2. The sectors (pieces or slices) of the pie graph show factor 1 – the contribution of each province to the GDP.
3. Units of measurement – the sectors of the pie graph show factor 1 (GDP) in percentage.
4. The relationship between the different factors – because a pie chart compares parts of a whole, you need to note the different sizes of the sectors. This tells you how much each province contributes to the total GDP.
5. Look for anything that is unusual – for example, which is the largest piece of the pie (Gauteng) and which is the smallest piece of the pie (Northern Cape).

Activity 4.6

The following questions refer to Figure 4.11 on page 121.

1. Rank the top three provinces in terms of their contribution to the GDP from largest to smallest contribution. (1 × 2 = 2)
2. Give two reasons why the province ranked first in your answer in question 1 holds that position. (2 × 2 = 4)
3. The following questions refer to the province which contributes the least to the national GDP.
   a) Name the province which contributes the least to the national GDP. (1 × 2 = 2)
   b) Name the ocean current that flows alongside this province. (1 × 2 = 2)
   c) What impact does this ocean current have on the rainfall in this province? (1 × 2 = 2)
   d) Explain how your answer in question c) affects the province’s contribution to the GDP. (2 × 2 = 4)
Answers to activity 4.6

1. Gauteng, KwaZulu-Natal, Western Cape ✓ ✓ (2)

2. Gauteng has the most industries ✓ ✓ / many tertiary activities ✓ ✓ / a large population which creates large market ✓ ✓ / many companies have main branches or headquarters there ✓ ✓ . (any 2) (4)

3. a) Northern Cape ✓ ✓ (2)
b) Benguela ✓ ✓ (2)
c) Decreases rainfall ✓ ✓ (2)
d) Less rainfall lowers productivity on farms so less produce to sell ✓ ✓ / Less rainfall causes poor water supply which limits industrial development. ✓ ✓ (4)

4.6.2 Understanding tables

In this section we look at how to read and understand the information in a table. Follow these steps when you read a table:

![Steps to read a table]

Step 1: Look at the heading for the table to see what is shown
Step 2: Look at the labels in the different columns
Step 3: Look at the relationship between what is compared
Step 4: Now read the questions

Carefully study the table in Figure 4.12 below and then follow the steps to read the table.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>SA's percentage of world production</th>
<th>World position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Chromium</td>
<td>76</td>
<td>1</td>
</tr>
<tr>
<td>Coal</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Diamonds</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>Iron</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Manganese</td>
<td>78</td>
<td>1</td>
</tr>
<tr>
<td>Platinum group</td>
<td>79</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 4.12: Example of a table
Steps

1. The heading – the table shows which minerals (factor 1) South Africa produces, how much we produce (factor 2), and where we are ranked in the world of production (factor 3).

2. The first column lists factor 1 (minerals), the second column shows factor 2 (percentage of world production), and the third column shows factor 3 (the country’s ranking in world production).

3. What mineral do we produce most of (manganese) and where are we ranked in the world for manganese (first)? For how many minerals do we rank in first or second place? (three – chromium, manganese and platinum group)

4. Now read the questions in activity 4.7.

Activity 4.7

The following questions refer to Figure 4.12 on page 123.

1. What economic activity does the extraction of minerals fall into? (1 × 2 = 2)

2. a) South Africa is a major mineral producer in the world. State three factors that favour mining in South Africa. (3 × 2 = 6)
   b) State the two reasons why mining is important to South Africa. (2 × 2 = 4)

3. What major mineral mined in South Africa is not listed in Figure 4.12? (1 × 2 = 2)

4. The price for platinum increased dramatically, but has now decreased again. What problems does this price fluctuation have on the platinum mines? (2 × 2 = 4)
Answers to activity 4.7

1. Primary ✓ ✓ (2)

2. a) The country has many different minerals ✓ ✓ / It has lots of local unskilled labour ✓ ✓ / It has access to many foreign skilled miners ✓ ✓ / Many countries invested money in our mines ✓ ✓ / The country has a well-developed infrastructure (roads and railway lines, water and electricity). ✓ ✓ (any 3) (6)

   b) Mines provide employment to many South Africans ✓ ✓ / Mines supply raw materials to factories ✓ ✓ / When mines start up, new towns and transport networks develop ✓ ✓ / Other economic activities, such as farming and trade, increase to meet the needs of the new mining towns ✓ ✓ / Harbours grow bigger ✓ ✓ / Export of mining products increases the profits of the mines. (any 2) (4)

3. Gold ✓ ✓ (2)

4. It will cause productivity to increase and decrease. ✓ ✓
   As productivity decreases, costs increase and profits fall. ✓ ✓
   It will cause the mine’s profits to increase and decrease. ✓ ✓
   As profits decrease, mine workers may lose their jobs. ✓ ✓
   (any 2 facts; or any other logical answer) (4)

[18]

Keep going!
5.1 Introduction

Mapwork is a practical section of Geography where you are required to apply all the different skills, techniques and the theory that you have learnt. It consists of the following sections:

- Mapwork calculations
- Reading, interpretation and analysis of theory
- Geographical Information Systems (GIS)

Maps tell you a story about a place. Look at all the information given on the map to interpret it:

- What is the name on the top of the map?
- Look at the latitude and longitude. Get an idea where the map is. For example, 20°S would indicate it is in Limpopo.
- Look at all the information provided (magnetic declination information, scale of the map, contour interval, map projection used) in the ‘margins’ of the map.
- Look at the bottom of the map, for the diagram showing map sheet reference. It may show additional information such as oceans or borders.
- Notice where roads or railways go off the map. The town they lead to may give you clues.
- Make use of the key/reference list to identify features. Remember, the first word in the reference list refers to the first picture and not both pictures.

Look for the following aspects on the map:

- Is this a high or low rainfall area? Is the rainfall seasonal?
- What kinds of rivers are visible and how many are there?
- Identify the urban and rural areas.
- Identify the different land uses in the mapped area, for example, agricultural/industrial/built-up areas.
- What factors may have affected the location of various land uses? For example, industry alongside a perennial river.
- Identify the type of farming – is it commercial or subsistence?
- Look at the relief – is it flat or hilly, are the slopes steep or gentle?
- Look at the contour lines to determine this.

Look at the information given in the orthophoto:

- Is the orthophoto labelled? If not, check the numbers or letters in the question, for example: ‘Identify land use labelled G on orthophoto’ – G will only be on one of the photos.
- Is a rectangle drawn around the area covered by the orthophoto? If not, orientate the photo to the map.
- Read the instructions carefully as you may need to use both the map and the photograph to answer a question.
- Make use of all the information on the orthophoto, for example, road names, heights, etc.
5.2 Some basic mapwork concepts

1. **Direction** is expressed using the points on a compass – North, South, East and West, and the points between them. These are known as the 16 cardinal points.

   Use the following mnemonic to remember the order of the compass points:
   
<table>
<thead>
<tr>
<th>N</th>
<th>Never</th>
<th>North</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>East</td>
<td>East</td>
</tr>
<tr>
<td>S</td>
<td>Silk</td>
<td>South</td>
</tr>
<tr>
<td>W</td>
<td>Worms</td>
<td>West</td>
</tr>
</tbody>
</table>

   ![Figure 5.1: The 16 cardinal points of a compass](image)

2. The **three main lines of latitude** that run across the surface of the Earth are the equator, the Tropic of Cancer and the Tropic of Capricorn. The **equator** is the longest line of latitude (where the Earth is widest in an East–West direction). It is located at 0 degrees latitude. The equator divides the planet into the northern and southern hemispheres. The **Tropic of Cancer** is located at 23.5° north of the equator. The **Tropic of Capricorn** lies at 23.5° south of the equator. The Tropic of Capricorn runs through northern South Africa.

   ![Figure 5.2: The three main lines of latitude](image)

3. Reading a map is as easy as reading a book but instead of using the alphabet, you have to know the **conventional signs** used in maps. These help you to see the landscape (relief, drainage, vegetation and human-made features). Conventional signs are used to show particular features. They may be letters of the alphabet or symbols. Many symbols look like the features they represent.
The following table lists some of the symbols you may find on a map:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>What it looks like</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weir</td>
<td>Represented as a black line across a river, like a dam wall. It is a barrier or mini dam wall which slows down the flow of water.</td>
</tr>
<tr>
<td>Furrow and canal</td>
<td>Represented as a solid blue line and labelled as furrow or canal. It is used to transport water from source (dam/river) to where it is needed.</td>
</tr>
<tr>
<td>Aerodrome</td>
<td>A small airport</td>
</tr>
<tr>
<td>Slimes dam</td>
<td>Represented as a solid black line forming a geometric shape, often rectangular. It stores liquid waste from the mining process.</td>
</tr>
<tr>
<td>Mine dump</td>
<td>Represented as solid lines radiating out from a central point. It is a small mountain-like feature, often yellowish in colour. It consists of solid waste from the mining process.</td>
</tr>
<tr>
<td>Rifle range/shooting</td>
<td>These are enclosed by a solid black line. This is a place where people practise shooting.</td>
</tr>
</tbody>
</table>

Table 5.1: Symbols found on maps

Colours are often used to make symbols clearer. There are six colour groups:

<table>
<thead>
<tr>
<th>Colour</th>
<th>What it is used for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>Land or earth features: Contours, eroded areas, prominent rocky outcrops, sandy areas and dunes, secondary or gravel roads</td>
</tr>
<tr>
<td>Blue</td>
<td>Water features: Aqueducts, canals, furrows, coastlines, dams, lakes, marshes, swamps and vleis, pans, rivers, water-towers. National freeways are also shown in blue</td>
</tr>
<tr>
<td>Green</td>
<td>Vegetation features: Cultivated fields, golf courses, nature and game reserve boundaries, state forest boundaries, orchards and vineyards, recreation grounds, woodland/plantations</td>
</tr>
<tr>
<td>Black</td>
<td>Construction features: Roads, tracks, railways, buildings, bridges, cemeteries, communication towers, dam walls, excavations and mine dumps, telephone lines, power lines, wind pumps, wrecks, ruins, trigonometrical beacons boundaries</td>
</tr>
<tr>
<td>Grey</td>
<td>Construction features: Built-up areas</td>
</tr>
<tr>
<td>Red</td>
<td>Construction features: National, arterial and main roads, lighthouses and marine lights. Pink also shows international boundaries</td>
</tr>
</tbody>
</table>

Table 5.2: Colours used on maps

4. **Contour lines** on a map show the area’s relief (the difference in elevation) or altitude (height in metres of the land above sea level). The closer together the contour lines are, the steeper the slope is. The lines are labelled so that you read up the slope.

![Figure 5.3: Contour lines of a steep slope](image1)

![Figure 5.4: Contour lines of gentle slope](image2)
5.3 Mapwork calculations

5.3.1 Introduction to mapwork calculations

In this section you will learn how to do various mapwork calculations on a topographic map and an orthophoto. These calculations will be explained by means of examples.

When doing calculations, you will be required to give an answer in kilometres or metres. Always take note of whether the calculation is to be done from a topographic map or an orthophoto, as this will change your scale. The orthophoto scale is larger and provides more detail. Use the conversion table below (Table 5.3).

<table>
<thead>
<tr>
<th>TOPOGRAPHIC MAP</th>
<th>ORTHOPHOTO MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cm : 50 000 cm</td>
<td>1 cm : 10 000 cm</td>
</tr>
<tr>
<td>1 cm = 500 m</td>
<td>1 cm: 100 m</td>
</tr>
<tr>
<td>1 cm = 0,5 km</td>
<td>1 cm: 0,1 km</td>
</tr>
</tbody>
</table>

Table 5.3: Converting a given scale to kilometres or metres

Topographic map extract

![1:50 000 South Africa](image)

Orthophoto map extract

![Orthophoto Map Series](image)

Calculations in mapwork need a good understanding of difference in height and straight line distance to calculate distance, gradient and area. Look at the example and revise these calculations.
Example
On a 1:50 000 map

Difference in height (vertical)
Simply subtract the smaller height from the greater height.
For example, to calculate the difference in height between spot height 1 260 and spot height 1 200:
1 260 − 1 200 = 60 m

Straight line distance (horizontal)
Measure the distance on the map in centimetres and multiply by the scale.
For example, to calculate the distance between spot height 1 200 and spot height 1 260 in kilometres:
Map distance = 2,4 cm
Scale: 1 cm represents 0,5 km
2,4 × 0,5 = 12 km

5.3.2 Mapwork calculations: distance, area and gradient
In the exam you may be asked to do distance, area and gradient calculations on a topographic map or an orthophoto. The following are examples of these calculations for both topographic maps and orthophotos. The method and formulae are the same for both kinds of maps, but remember to use the correct conversion calculation (see Table 5.3) on page 129.

5.1.2A Distance
This is the straight line distance from one point to another or the actual distance, e.g distance along a road, railway, hiking trail, etc.

We calculate distance to find out how far one place is from another.

Formula
Actual distance = map distance \times \text{scale}
AD = MD \times S

Method for calculating distance
Follow these steps:
Step 1: Measure the map distance in centimetres.
Step 2: To convert to kilometres, multiply the map distance by 0,5 if on a topographic map, or by 0,1 if on an orthophoto to get km. To convert to metres, multiply the map distance by 500 if on a topographic map or by 100 if on an orthophoto.
**Worked example 1 - straight line distance**

Calculate the distance from point A to point B.

<table>
<thead>
<tr>
<th>Topographic map calculation:</th>
<th>Orthophoto calculation:</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Map A to B 1:50 000" /></td>
<td><img src="image" alt="Map A to B 1:10 000" /></td>
</tr>
<tr>
<td>Map distance: 4,6 cm</td>
<td>Map distance: 4,6 cm</td>
</tr>
<tr>
<td>Scale: 1 cm represents 0,5 km</td>
<td>Scale: 1 cm represents 0,1 km</td>
</tr>
<tr>
<td>Distance: 4,6 cm × 0,5 = 2,3 km</td>
<td>Distance: 4,6 cm × 0,1 = 0,46 km</td>
</tr>
</tbody>
</table>

**Worked example 2 - actual distance**

Calculate the distance along the road from point A to point B.

<table>
<thead>
<tr>
<th>Topographic map calculation:</th>
<th>Orthophoto calculation:</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Map A to B 1:50 000" /></td>
<td><img src="image" alt="Map A to B 1:10 000" /></td>
</tr>
<tr>
<td>Map distance: 3 cm</td>
<td>Map distance: 3 cm</td>
</tr>
<tr>
<td>Scale: 1 cm represents 0,5 km</td>
<td>Scale: 1 cm represents 0,1 km</td>
</tr>
<tr>
<td>Distance: 3 cm × 0,5 = 1,5 km</td>
<td>Distance: 3 cm × 0,1 = 0,3 km</td>
</tr>
</tbody>
</table>

**Activity 5.1**

Calculate the following distances which are shown on a topographic map.

1. Calculate the distance from trig. beacon 5 to spot height 120 in metres. (3)
2. Calculate the distance along the powerline in kilometres. (3)

If the exam question asks for “the distance along a road” then you would measure the line as if you were walking on it.
Answers to activity 5.1

1. Distance = 4,4 cm \times 500 = 2200 m \ (3)
2. Distance = 6,8 cm \times 0,5 = 3,4 km \ (3)

Activity 5.2

Calculate the following distances which are shown on an orthophoto.

1. Calculate the distance from the post office to the dipping tank in metres. \ (3)
2. Calculate the distance along the track in kilometres. \ (3)

Answers to activity 5.2

1. Distance = 6,6 cm \times 100 = 660 m \ (3)
2. Distance = 5,4 cm \times 0,1 = 0,54 km \ (3)

5.3.2B Area

Area is the amount of surface a two-dimensional shape covers. (A two-dimensional shape has length and breadth.)

We calculate area to find out how much land is covered (e.g. by a maize field) or how much space we have to build on.

Formula for area

Area = Length \times Breadth

A = L \times B

Method for calculating area

Follow these steps:

Step 1: Measure the length in cm and convert to km or m.
Step 2: Measure the breadth in cm and convert to km or m.
Step 3: Apply the formula A = L \times B.
Step 4: Write the answer in kilometres squared (km²) or metres squared (m²).
Worked example


<table>
<thead>
<tr>
<th>Topographic map calculation:</th>
<th>Orthophoto calculation:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td><strong>Length</strong></td>
</tr>
<tr>
<td>4,4 cm</td>
<td>4,4 cm</td>
</tr>
<tr>
<td>3,6 cm</td>
<td>3,6 cm</td>
</tr>
<tr>
<td>1: 50 000</td>
<td>1: 10 000</td>
</tr>
</tbody>
</table>

**Answer in km²**

\[
A = L \times B \\
L: 4,4 \text{ cm} \times 0,5 = 2,2 \text{ km} \\
B: 3,6 \text{ cm} \times 0,5 = 1,8 \text{ km} \\
A: 2,2 \times 1,8 = 3,96 \text{ km}^2
\]

**Answer in m²**

\[
A = L \times B \\
L: 4,4 \text{ cm} \times 500 = 2 200 \text{ m} \\
B: 3,6 \text{ cm} \times 500 = 1 800 \text{ m} \\
A: 2 200 \times 1 800 = 39 600 \text{ m}^2
\]

Activity 5.3

1. The block below is shown on a topographic map. Calculate the area of the block in metres squared. (5)

2. The block below is shown on a topographic map. Calculate the area of the block in kilometres squared. (5)

[10]
Answers to activity 5.3

1. \( A = L \times B \)
   
   \[ \begin{align*}
   L & : 3,7 \text{ cm} \times 500 = 1850 \text{ m} \\
   B & : 1,1 \text{ cm} \times 500 = 550 \text{ m} \\
   A & : 1850 \times 550 = 1017500 \text{ m}^2 \\
   \end{align*} \]

   (5)

2. \( A = L \times B \)
   
   \[ \begin{align*}
   L & : 4,4 \text{ cm} \times 0,5 = 2,2 \text{ km} \\
   B & : 2,3 \text{ cm} \times 0,5 = 1,15 \text{ km} \\
   A & : 2,2 \times 1,15 = 2,53 \text{ km}^2 \\
   \end{align*} \]

   (5)

[10]

Activity 5.4

1. The block below is shown on an orthophoto. Calculate the area of the block in metres squared. (5)

2. The block below is shown on an orthophoto. Calculate the area of the block in kilometres squared. (5)

Answers to activity 5.4

1. \( A = L \times B \)
   
   \[ \begin{align*}
   L & : 4,4 \text{ cm} \times 100 = 440 \text{ m} \\
   B & : 1,1 \text{ cm} \times 100 = 110 \text{ m} \\
   A & : 440 \times 110 = 48400 \text{ m}^2 \\
   \end{align*} \]

   (5)

2. \( A = L \times B \)
   
   \[ \begin{align*}
   L & : 1,1 \text{ cm} \times 0,1 = 0,11 \text{ km} \\
   B & : 1,1 \text{ cm} \times 0,1 = 0,11 \text{ km} \\
   A & : 0,11 \times 0,11 = 0,0121 \text{ km}^2 \\
   \end{align*} \]

   (5)

[10]
5.3.2C Gradient

Gradient is the relationship between height and distance. The gradient tells us how steep a straight line is.

We calculate gradient to find out how steep or gentle a slope is.

**Formula for gradient**

\[
\text{Gradient} = \frac{\text{Height (vertical)}}{\text{Distance (horizontal)}}
\]

**OR**

\[
G = \frac{H}{D}
\]

**Method for calculating gradient**

Follow these steps:

**Step 1:** Calculate the difference in height by subtracting the lowest height from the highest height. The answer must be in metres.

**Step 2:** Measure the distance in cm.

**Step 3:** Convert to metres by multiplying by 500 (if you are working with a topographic map) or by 100 (if you are working with an orthophoto).

**Step 4:** Write the two answers as a ratio.

**Step 5:** Divide both sides of the ratio by the height. This is so we can get a ratio of 1 to a relative number, in other words, distance.

**Step 6:** Your answer is the gradient written as a ratio.

**Worked example**

**Topographic map calculation:**

Calculate the gradient between -5400 and -5000

\[G = \frac{H}{D}\]

H: 5 400 – 5 000 = 400 m
D: 2,2 cm \times 500 = 1 100 m

\[
\frac{400}{400} = 1:2,75
\]

**Orthophoto calculation:**

Calculate the gradient between -5400 and -5000

\[G = \frac{H}{D}\]

H: 5 400 – 5 000 = 400 m

D: 2,2 cm \times 100 = 220 m

\[
\frac{400}{400} = 1:0,55
\]

Always write the formula \( G = \frac{H}{D} \) in your answer. This will give you a mark.
Activity 5.5

Calculate the gradient from trig. beacon 8 to spot height 1120, which are shown on a topographic map.

Answer to activity 5.5

\[ G = \frac{H}{D} \checkmark \]

\[ H: 1120 - 980 = 140 \text{ m} \checkmark \]

\[ D: 4.4 \text{ cm} \times 500 = 2200 \text{ m} \checkmark \]

\[ G: \frac{140}{2200} \checkmark \]

\[ \frac{140}{140} \]

\[ = 1:15.71 \checkmark \]

Activity 5.6

Calculate the gradient from trig. beacon 8 to spot height 213, which are shown on an orthophoto.
5.3.3 Mapwork calculations

**True bearing, magnetic declination, magnetic bearing, position, map sheet reference, vertical exaggeration**

Note that true bearing, magnetic declination, magnetic bearing and position, and map sheet reference calculations can only be done on a topographic map. Vertical exaggeration calculations can be done on both a topographic map and an orthophoto.

### 5.3.3A True bearing

**True bearing** is the angle measured clockwise from true north (0°).

We calculate true bearing, magnetic declination and magnetic bearing to help us determine in which direction we are going or to help us find our way.

**Method for measuring the true bearing from A to B**

Follow these steps:

- **Step 1:** Draw a straight line joining A and B.
- **Step 2:** Draw a north line through A (the point of measurement).
- **Step 3:** Place the 0 of your protractor at the top of the north line.
- **Step 4:** Moving in a clockwise direction from 0, read off where the line joining A and B touches the protractor.

The true bearing from A to B is 138°. (In the exam, a degree either way will be accepted, i.e. the answer can be 137° to 139°.)
Activity 5.7

1. Calculate the true bearing from trig. beacon 8 to spot height 110. (2)
2. Calculate the true bearing of trig. beacon 8 from spot height 110. (2)

Answers to activity 5.7

1. $53^\circ$ ($57^\circ - 59^\circ$) $\checkmark \checkmark$ (2)
2. $238^\circ$ ($237^\circ - 239^\circ$) $\checkmark$ (2)

5.3.3B Magnetic declination

Magnetic declination is the angle between true north and magnetic north. This angle is calculated when the map is drawn, but the position of magnetic north changes, so the angle between true north and magnetic north (the magnetic declination) will also change. You will need to calculate what the magnetic calculation is for the current year.
You will find the magnetic declination for the year the map was drawn on the map. This information appears on a map on the left-hand side or at the bottom of the map. You need this information to do the magnetic declination calculation. Look at the following example:

**Example**
Mean magnetic declination (MD) 20° 10' west of true north (1990.01)
Mean annual change (AC) 2' westwards (1985–1995)

Note the following:
- **TN** is true north. This is found at the North Pole.
- **MN** is magnetic north. This is the direction in which a compass would point.
- **MD** is the magnetic declination. It is the angle you are calculating.
- 1990.01 refers to the year and the month that the declination was recorded.
- 1985–1995 refers to the years the mapmaker used to get the mean (average) magnetic declination. You will not need these years.
- Mean annual change refers to how much the magnetic declination changes by each year. The change is in minutes (this is shown by the symbol ').
- The declination can change in a westerly (angle increases) or easterly (angle decreases) direction.

### Method for calculating magnetic declination

Follow these steps:

**Step 1:** Work out the difference in years between the current year and year given on the map. Your answer must be in years. (Use the year that is printed straight after the words 'true north'. You can ignore the month that is shown.)

**Step 2:** Multiply the number of years with the mean annual change (this is given on the map) to get the change since the declination was recorded.

**Step 3:** If the mean annual change is **eastwards**, then you have to **subtract** the change from the magnetic declination given. If the mean annual change is **westwards**, then you must **add** it to the given magnetic declination.

**Step 4:** Your answer is the magnetic declination for the current year. Magnetic declination is always west of true north.
Worked example 1: If the annual change is westwards

Mean magnetic declination (MD) 20° 10' west of true north (1990.01)
Mean annual change (AC) 2' westwards (1985–1995)

Calculating magnetic declination for the current year

\[ MD = 20°\ 10' \text{ W of TN} \]
\[ AC = 2' \text{ W} \]
\[ 2012 - 1990 = 22 \text{ years} \]
\[ 22 \times 2' \text{ W} = 44' \text{ W} \]
\[ MD = 20°\ 10' \text{ W} + 44' \text{ W} = 20°\ 54' \text{ W of TN} \]

Worked example 2: If the annual change is eastwards

Mean magnetic declination (MD) 18° 50' west of true north (1985.01)
Mean annual change (AC) 1' eastwards (1980–1990)

Calculating magnetic declination for the current year

\[ MD = 18°\ 50' \text{ W of TN} \]
\[ AC = 1' \text{ E} \]
\[ 2012 - 1985 = 27 \text{ years} \]
\[ 27 \times 1' \text{ E} = 27' \text{ E} \]
\[ MD = 18°\ 50' \text{ W} - 27' \text{ E} = 18°\ 23' \text{ W of TN} \]
Remember that
1° = 60' (1 degree = 60 minutes)

Worked example 3: If the magnetic declination is given with a decimal place instead of minutes

If the MD given on the map is recorded as a decimal, for example 23°.5 W, you must multiply the number after the comma by 6 to convert it to minutes. For example: 5 × 6 = 30'. So, the MD is now 23° 30' W. The decimal comma has been removed and you have an MD in degrees and minutes.

Now look at the following worked example:
Mean magnetic declination (MD) 18°.3 west of true north (1985.01)
Mean annual change (AC) 1' westwards (1980–1990)

Calculating magnetic declination for the current year

MD = 18°.3 W of TN = 18° 18' W of TN
AC = 1' W
2012 – 1985 = 27 years
27 × 1' W = 27' W
MD = 18° 18' W + 27' W = 18° 45' W of TN

Worked example 4: If the magnetic declination answer has the minutes greater than 59'

Once you have done your calculation, if the magnetic declination for the current year has minutes greater than 59' you need to convert the minutes to degrees.

For example: MD = 23° 76'
76' – 60' leaves 16'. The 60 minutes you subtracted equal 1 degree, which you add to the 23° to get 24° 16'.

Now look at the following worked example:
Mean magnetic declination (MD) 31° 33' west of true north (1990.08)
Mean annual change (AC) 2' westwards (1987–1993)
Calculating magnetic declination for the current year

MD = 31° 33' W of TN
AC = 2' W
2012 - 1990 = 22 years
22 × 2' W = 44' W
MD = 31° 33' W + 44' W
= 31° 77' W of TN
= 32° 17' W of TN

Worked example 5: When the change is eastwards and the change is greater than the minutes in the MD

If the mean annual change has minutes greater than the minutes in the magnetic declination, you need to borrow a degree in the magnetic declination and convert it into minutes. Look at the following example:

MD = 20° 10' W – 44' E

Before you can subtract the mean annual change of 44' E from the given magnetic declination, you need to borrow 1° from 20° and convert it to minutes. This leaves you with 19°. Now take the 1° and convert it to 60' (remember that 1° = 60'). Now add the 60' to the 10'. This gives you 70'. Now you can continue with the calculation:

19° 70' - 44' E = 19° 26' W

Now look at the following worked example:
Mean magnetic declination (MD) 25° 32' west of true north (1986.04)
Mean annual change (AC) 2' eastwards (1983–1992)

Calculating magnetic declination for the current year

• Always add degrees to degrees and minutes to minutes. Never add degrees to minutes.
• Always subtract degrees from degrees and minute from minutes. Never subtract minutes from degrees!
MD = 25° 32' W of TN
AC = 2' E
2012 – 1986 = 26 years
26 × 2' E = 52' E
MD = 25° 32' W – 52' E
= 24° 92' – 52'
= 24° 40' W of TN

5.3.3C Magnetic bearing

Magnetic bearing is the angle measured clockwise from magnetic north. Here the magnetic north line is taken as 0° whereas in true bearing, true north is taken as 0°.

Formula for magnetic bearing
Magnetic bearing = true bearing + magnetic declination
MB = TB + MD
Method for calculating magnetic bearing

To get the true bearing and the magnetic declination we use the same methods applied in 5.3.3A (on page 137) and 5.3.3B (on page 138).

These methods are provided again below. Follow these steps:

**Step 1:** Measure the true bearing from A to B (as described in 5.1.3A)

**Step 1a:** Draw a straight line joining A and B.

**Step 1b:** Draw a north line through A (the point of measurement).

**Step 1c:** Place the 0 of your protractor at the top of the north line.

**Step 1d:** Moving in a clockwise direction from 0, read off where the line joining A and B touches the protractor.

**Step 2:** Calculate the magnetic declination (as described in 5.1.3B)

**Step 2a:** Work out the difference in years between the current year and year given on the map. Your answer must be in years. (Use the year that is printed straight after the words ‘true north’. You can ignore the month that is shown.)

**Step 2b:** Multiply the number of years with the mean annual change (this is given on the map) to get the change since the declination was recorded.

**Step 2c:** If the mean annual change is eastwards, then you have to subtract the change from the magnetic declination given. If the mean annual change is westwards, then you must add it to the given magnetic declination.

**Step 2d:** Your answer is the magnetic declination for the current year. Magnetic declination is always west of true north.

**Step 3:** Now add the true bearing to the magnetic declination. Your answer must not have a direction (north, south, east or west) because it is an angle measured only in degrees and minutes.

**Example**

MD = 17° 8’ W = 17° 48’ W

Change in years = 2012 – 1988 = 24 years

Change since 1989 = 24 × 4’ = 96’ W = 1° 36’ W

MD = 17° 48’ + 1° 36’

= 18° 84’ W = 19° 24’ W

TB = between 299° and 303°

MB = TB + MD

= 301° + 19° 24’

MB = 320° 24’
Worked example 1

Mean magnetic declination (MD) 20° 2' west of true north (2001.09)
Mean annual change (AC) 1' westwards (1998–2004)

Calculate the magnetic bearing of the post office from the dipping tank for 2012.

MB = TB + MD
TB = 272° (271° – 273°)
MD = 20° 2' W of TN = 20°12' W of TN
AC = 1' W
2012 – 2001 = 11 years
11 × 1' W = 11' W
MD = 20° 12' W + 11' W = 20° 23' W of TN
MB = 20° 23' + 272°
    = 291° 23'– 293° 23'
Calculate the magnetic bearing from trig. beacon 8 to spot height 120 for 2012.

MB = TB + MD
TB = 57° (56° – 58°)
MD = 20° 31' W of TN
AC = 4’ W
2012 – 1998 = 14 years
14 × 4’ W = 56’ W
MD = 20° 31’ W + 56’ W
= 20° 87’ W of TN
= 21° 27’ W of TN
MB = 21° 27’ + 57°
= 77° 27’ – 79° 27’

Exams
For more questions on true bearing, magnetic declination and magnetic bearing refer to the following national Geography exam papers:
• Geography Paper 2 February /March 2011 – HUMANSDORP, 2.3
• Geography Paper 2 November 2010 – HUMANSDORP, 2.1
5.3.3D Position/co-ordinates

Co-ordinates are a set of two numbers that indicate the exact position of any point on Earth. **Latitude** is the co-ordinate that specifies the north–south position of a point on the Earth’s surface. **Longitude** is the co-ordinate that specifies the east–west position of a point on the Earth’s surface.

Co-ordinates are useful as they tell us exactly where a place or landform is.

**Example of position/co-ordinates**

If you wanted to locate a house and only had the co-ordinates 35° S 29° E, you would have to search an area of 6 084 km². You would need to be more specific when giving the location of a place.

Note the following about position/co-ordinates:

- On a 1:50 000 map the numbers in the top left corner indicate latitude and longitude. Latitude and longitude are measured in degrees and minutes.

  - 29° 31’
  - (longitude)

  - 35° 12’
  - (latitude)

- Each line drawn on a map is 1’ of latitude or longitude (’ is the sign for a minute).
- Each fifth minute on a map is labelled. This helps you to count accurately.
- Latitude minutes increase as you move south (down the map).
- Longitude minutes increase as you move east (to your right along the map).
- The **correct format** for writing position is as follows:
  - ____° ____.’’ S
  - ____° ____.’’ E

**Method for finding the position of an object**

You can calculate the position of spot height 501 using the diagram in Figure 5.5.

**Figure 5.5**
Use the following steps:

Step 1: Write the format for position like this (leaving the blanks for you to fill your answer in later).

   _____° _____,___' S
   _____° _____,___' E

Step 2: Work out the degrees for latitude and longitude for the map. They are written in the top left-hand corner of the map. Write the degrees down on your format.

   24° _____,___' S
   31° _____,___' E

Step 3: Work out the minutes for latitude and longitude. The spot height is in the 10' block for latitude (not the 11' block for latitude) and the 28' block for longitude (not the 29' block for longitude). Write the minutes down in the blank spaces of your position format.

   24° 10',___' S
   31° 28',___' E

Step 4: Measure the distance between 10' and 11' and divide it by 2. Then make a mark on the line between 10' and 11' where 3 cm is.

   31° 28' 31° 29'

Step 5: Measure the distance between 28' and 29' and divide it by 2. Make a mark on the line between 28' and 29' where 4,7 cm is.

Step 6: The space between 10' and 11' is divided into 10 decimal places, in other words, 10,1'; 10,2'; 10,3'; 10,4'; 10,5'; 10,6'; 10,7'; 10,8'; and 10,9'.

As the spot height is in the bottom half of the block, we are only concerned with the 10,5' to 10,9' part of the block.

Once you have divided the block in half, divide the half you are interested in equally with 4 lines. This can be done freehand (without a ruler), but judge carefully so that the spaces are equal.
Step 7: The space between 28' and 29' is divided into 10 decimal places, in other words, 28,1'; 28,2'; 28,3'; 28,4'; 28,5'; 28,6'; 28,7'; 28,8' and 28,9'.

As the spot height is in the right-hand half of the block, we are only concerned with the 28,5' to 28,9' part of the block.

Once you have divided the block in half, divide the half you are interested in equally with 4 lines. This can be done freehand (without a ruler), but judge carefully so that the spaces are equal.

Steps 6 and 7 are shown below:

Step 8: Line up your ruler with the spot height and the line for latitude (on the left of the map). Make a mark. Read off the decimal place for latitude and write it down on your position format.

24° 10,8' S or 24° 10,9' S (both answers are acceptable)

Step 9: Line up your ruler with the spot height and the line for longitude (at the top of the map). Make a mark. Read off the decimal place for longitude and write it down on your format.

31° 28,8' E

In the exam, position is often asked in the multiple-choice section of the paper. Be careful, as an answer may look correct – but longitude is written first! You should know this is wrong because latitude is always written first!

Example
The position of spot height 501 in Figure 5.1 is...

A. 31° 28,8' S; 24°10,8' E
B. 31° 28,8' E; 24° 10,8' S
C. 24° 10,8' S; 31° 28,8' E
D. 24°11,8' S; 31° 29,8' E
(The correct answer is C.)
5.3.3E Map sheet references/map code

The map sheet reference is the title of the map and refers to the area that the map covers. The sheet reference links one South African map to all the maps of South Africa.

An example of a map sheet reference is 3318CD. The digits (numbers) and letters have specific meaning:

The numbers in the map sheet reference refer to the intersection of the lines of latitude and longitude (3318CD). The first two numbers refer to latitude (33) and the last two numbers refer to longitude (18). The letters CD refer to the blocks.

The area within these lines of latitude and longitude is divided into four squares, labelled A, B, C and D (big blocks).

Each of the big blocks is then subdivided into four smaller squares, also labelled A, B, C and D (small blocks).

Example 1

For the map title 3318CD Cape Town:

Give the map sheet reference to the east of 3318CD.
• The block to the east of 3318CD (light shading) is block C (darker shading).
• This block is still within the 33° latitude and 18° longitude area, so the numbers (3318) stay the same.
• But it is now in big block D, so the letters change to DC.
• The map sheet to the east of 3318CD is 3318DC.

**Practise this type of question by trying the following:**
1. Give the map sheet reference for the map to the north of 3318CD.
2. Give the map sheet reference for the map to the north-east of 3318CD.
3. Give the map sheet reference for the map to the north-west of 3318CD.

**Answers:**
1. 3318CB
2. 3318DA
3. 3318CA

**Example 2**
For the map title 3318CD Cape Town.

Give the map sheet reference to the south of 3318CD.
• The block to the south of 3318CD (light shading) is the block B (darker shading).
• This block is out of the 33° latitude area and in the 34° latitude area. However, the block is still within the 18° longitude area. The latitude changes but the longitude stays the same (3418).
• It is now in big block A, so the letters change to AB.
• The map sheet to the south of 3318CD is 3418AB.
## 5.3.3F Vertical exaggeration

In mapwork, we draw a cross section (view from the side) of an area or landform to better understand what the area or landform looks like.

A cross section is when we ‘cut’ through a landform, to see what it looks like from the side. Figure 5.2 below shows a cross section through a tap.

### When answering this type of question, take note of the following:

- If you are asked for the grid reference north and you go north (up) out of the big block, the latitude must decrease by 1°.
- If you are asked for the grid reference south and you go south (down) out of the big block, the latitude must increase by 1°.
- If you are asked for the grid reference east and you go east (right) out of the big block, the longitude must increase by 1°.
- If you are asked for the grid reference west and you go west (left) out of the big block, the longitude must decrease by 1°.

### 5.3.3F Vertical exaggeration

In mapwork, we draw a cross section (view from the side) of an area or landform to better understand what the area or landform looks like.

A cross section is when we ‘cut’ through a landform, to see what it looks like from the side. Figure 5.2 below shows a cross section through a tap.

### Study Figure 5.6 to understand what is meant by the term cross section.

**Figure 5.6: A cross section through a tap**

To draw a cross section of a landform, we need to look at the contour lines. These are the brown lines we see all over a topographic map. Contour lines show the height of the area. Along one contour line, the height is the same.
Figure 5.7 below is a contour map of a landform. If we had to draw a cross section from A to B on Figure 5.7 we would first imagine we were walking from A to B:

- Looking at the heights on the contours we see we are walking uphill;
- Then we go downhill a little bit;
- Then uphill again; and
- Then downhill to B.

Figure 5.7: A contour map of a landform

A cross section is drawn on a graph. We use the vertical axis to show the height and horizontal axis to show the distance.

If the vertical and horizontal scales are the same, it is not easy to see the differences in slope.

Figure 5.8 below shows the cross section from A to B (in Figure 5.3). Because the vertical and horizontal scales are the same (1:10 000), we do not really get a good idea of the differences in slope.

Figure 5.8: Cross section from A to B (vertical and horizontal scales the same)
To overcome this problem, we exaggerate (make it more obvious or clear) the profile vertically by using a different vertical scale from the horizontal scale. This is shown in Figure 5.9.

Figure 5.9 uses a vertical scale where 1 cm represents 20 m for the same map. It is much easier to see the changes in slope along the profile.

We therefore say the cross-section has been exaggerated, and we need to calculate how many times it has been made steeper or exaggerated. This is called the **vertical exaggeration**.

Formula to calculate vertical exaggeration

Vertical exaggeration = Vertical scale divided by Horizontal scale

\[ \text{VE} = \frac{\text{VS}}{\text{HS}} \]

or

\[ \text{VE} = \frac{\text{VS}}{\text{HS}} \]

Remember the horizontal scale lies the same way as the horizon.

**Figure 5.9: Cross-section from A to B (vertical and horizontal scales differ)**

We therefore say the cross-section has been exaggerated, and we need to calculate how many times it has been made steeper or exaggerated. This is called the **vertical exaggeration**.
Method for calculating vertical exaggeration

Follow these steps:

**Step 1:** Change the vertical scale from a word scale to a number scale. The vertical scale will be given to you in the question, e.g. 1 cm = 40 m.

You must have the same units on both sides of the vertical scale in order to write it as a number scale. We need to convert 40 m into cm. To do this you multiply the 40 m by 100 (1 m = 100 cm).

Our scale becomes 1 cm = 4 000 cm or \( \frac{1}{4 000} \).

**Step 2:** The horizontal scale is already written as a number scale. On a topographic map the scale is 1:50 000 and on an orthophoto the scale is 1:10 000.

**Step 3:** Write both scales as fractions and divide the vertical scale by the horizontal scale:

\[
VE = \frac{1}{4000} \div \frac{1}{50000}
\]

**Step 4:** Now ‘tip and times’ the two fractions. You do this by swapping the top and bottom numbers of the horizontal scale fraction and then multiplying the top of each fraction together and the bottom of each fraction together.

\[
VE = \frac{1}{4000} \times 50 000 \times \frac{1}{1}
\]

**Step 5:** You are now left with one fraction. Divide the top by the bottom.

(Use your calculator to divide 50 000 by 4 000.)

\[
VE = \frac{50 000}{4 000}
\]

An easy way to remember that the horizontal scale goes on top is that ‘H’ comes before ‘V’ in the alphabet.

**Step 6:** Write the answer as follows:

\[
VE = 12.5 \times
\]

This means the cross section has been exaggerated 12.5 times in order to see the changes in the landscape more easily.
### Example of a topographic map calculation:

Calculate the vertical exaggeration for a cross section drawn on a topographical map with a vertical scale of 1 cm = 20 m.

\[ VE = \frac{VS}{HS} \]

**Step 1:**

VS: 1 cm = 20 m
1 cm = 20 × 100 cm = 2000 cm
VS 1:2000

\[ VS = \frac{1}{2000} \]

**Step 2:**

HS 1:50 000

\[ HS = \frac{1}{50 000} \]

**Step 3:**

\[ VE = \frac{1}{2000} \div \frac{1}{50 000} \]

\[ VE = \frac{1}{2000} \times \frac{50 000}{1} \]

**Step 5:**

\[ VE = \frac{50 000}{2000} \]

**Step 6:**

Answer:

\[ VE = 25 \text{ times} \]

---

### Example of an orthophoto calculation:

Calculate the vertical exaggeration for a cross section drawn on an orthophoto with a vertical scale of 1 cm = 20 m.

\[ VE = \frac{VS}{HS} \]

**Step 1:**

VS: 1 cm = 20 m
1 cm = 20 × 100 cm = 2000 cm
VS 1:2000

\[ VS = \frac{1}{2000} \]

**Step 2:**

HS 1:10 000

\[ HS = \frac{1}{10 000} \]

**Step 3:**

\[ VE = \frac{1}{2000} \div \frac{1}{10 000} \]

\[ VE = \frac{1}{2000} \times \frac{10 000}{1} \]

**Step 5:**

\[ VE = \frac{10 000}{2000} \]

**Step 6:**

Answer:

\[ VE = 5 \text{ times} \]

---

**Worked example 1**

Calculate the vertical exaggeration for a cross section drawn on a topographical map with a vertical scale of 1 cm = 50 m.

**Answer**

\[ VE = \frac{VS}{HS} \]

VS: 1 cm = 50 m
1 cm = 50 × 100 cm = 5000 cm
VS 1:5000

\[ VS = \frac{1}{5000} \]

HS 1:50 000

\[ HS = \frac{1}{50 000} \]

\[ VE = \frac{1}{5000} \div \frac{1}{50 000} \]

\[ VE = \frac{1}{5000} \times \frac{50 000}{1} \]

\[ VE = \frac{50 000}{5000} \]

\[ VE = 10 \text{ times} \]
Worked example 2

Calculate the vertical exaggeration for a cross section drawn on an orthophoto map with a vertical scale of 1 cm = 25 m.

Answer

\[ \text{VE} = \frac{\text{VS}}{\text{HS}} \]

\[ \text{VS: 1 cm} = 25 \text{ m} \]

\[ 1 \text{ cm} = 25 \times 100 \text{ cm} = 2500 \text{ cm} \]

\[ \text{VS 1:2 500} \]

\[ \text{HS 1:10 000} \]

\[ \text{VE} = \frac{1}{2500} \div \frac{1}{10000} \]

\[ \text{VE} = \frac{1}{2500} \times \frac{10000}{1} \]

\[ \text{VE} = \frac{10000}{2500} \]

\[ \text{VE} = 4 \text{ times} \]

5.3.3G Intervisibility

Intervisibility is used to determine whether one place is visible from another place, in other words, whether you can see one place from another place.

Method to determine intervisibility

To work out whether two places are intervisible, follow these steps:

**Step 1:** Draw a line joining the points between the two places.

**Step 2:** Look to see if the line you have drawn cuts through any part of the cross section. If it does cut through, then there is no intervisibility between the two points. If it does not cut through, then there is intervisibility between the two points.
Example 1
In Figure 5.10 below, is point Q intervisible from point P?

Figure 5.10: Determining intervisibility between points P and Q

The answer is that there is no intervisibility between P and Q, as the line cuts through the cross-section (goes through the mountain). This means you cannot see point Q from point P, and you cannot see point P from point Q.

Example 2
In Figure 5.11 below, is point X intervisible from point Q?

Figure 5.11: Determining intervisibility between points X and Q

The answer is there is intervisibility between X and Q, as the line does not cut through the cross-section. This means you can see point X from point Q, and you can see point Q from point X.

For more questions on position and co-ordinates, vertical exaggeration and intervisibility refer to the following national Geography exam papers:

- Geography Paper 2 February/March 2011 – HUMANSDORP Question 1.9; 2.1.2; 2.2.
- Geography Paper 2 November 2010 – HUMANSDORP Question 1.7; 1.8.
Refer to the topographical map and orthophoto of Nelspruit at the back of this study guide to answer the following questions:

1. Calculate the area covered by block B3 on the Nelspruit topographical map in kilometres squared.

2. Calculate the magnetic bearing for 2012 from trig. beacon 101 (C3) to spot height 676 (C4) on the topographical map. Show all steps followed (calculations). Marks will be allocated for calculations.

3. Calculate the gradient between trig. beacon 101 in block C3 and spot height 676 in block C4.

Answers to activity 5.8

1. Area = length × breadth
   \[ = (3.7 \text{ cm} \times 0.5) \text{ km} \times (3.3 \text{ cm} \times 0.5) \text{ km} \]
   \[ = 1.85 \text{ km} \times 1.65 \text{ km} \]
   \[ = 3.05 \text{ km}^2 \] (5)

2. Magnetic declination:
   - 15°02' west of true north
   - Annual change: 03' E
   - Number of years: 2012 – 1986 = 26 years
   \[ 26 \times 3' = 78' = 1° 18' \text{ E} \]
   - Magnetic declination: 15°02' W – 1°18' E
   \[ = 14° 62' W – 1° 18' \text{ E} \]
   \[ = 13° 44' \text{ W} \]
   - Magnetic bearing = True bearing + Magnetic declination
   \[ = 102° + 13° 44' \text{ W} \]
   \[ = 115° 44' \text{ W} \] (8)

3. Gradient = \( \frac{\text{Height}}{\text{Distance}} \)
   \[ \frac{754.4 - 676}{5.6 \text{ cm} \times 500} = \frac{78.4}{2800} \text{ m} \]
   \[ \frac{78.4}{78.4} = 1:35.7 \] (5)
5.4 Application of theory to a topographic map and an orthophoto

In this section we look at how the theory that you have learnt in previous chapters can be applied to a topographic map or an orthophoto.

5.2.1 Climatology

In the exam, you may be asked questions such as:

1. Which slopes are the warmest?
   
   **Hint:** Determine which slope faces north. North-facing slopes are the warmest.

2. Which slopes are the coldest?
   
   **Hint:** Determine which slope faces south. South-facing slopes are the coldest.

3. Why are there more houses and plantations on a slope in a valley?
   
   **Hint:** Determine which slope faces north. North-facing slopes are the warmest and people choose to live there. Plants also grow better there.

4. Where will the thermal belt occur?
   
   **Hint:** Determine where the valley is and where halfway up the valley would be. This is where you will find the thermal belt (temperature inversion).

5. Where will frost occur?
   
   **Hint:** Determine where the bottom of the valley is. Frost pockets occur at the bottom of a valley.

6. Does the area experience high rainfall?
   
   **Hint:** Determine the amount of cultivated land, the number of perennial rivers (flow all year round) and the total number of rivers in an area (drainage density). High-rainfall areas have lots of cultivated land, many perennial rivers indicate high drainage density.
7. Does the area experience low rainfall?

**Hint** Determine the amount of cultivated land, the number of perennial rivers (flow all year round) and non-perennial rivers (only flow in the rainy season), and the total number of rivers in an area (drainage density). Low-rainfall areas have very little cultivated land; few, if any, perennial rivers and many non-perennial rivers; and few rivers, indicating low drainage density.

8. Does the area experience seasonal rainfall?

**Hint** Determine the number of non-perennial streams, dams, furrows and whether the cultivated land is next to a river. Seasonal rainfall areas have mostly non-perennial rivers, many dams, furrows and the cultivated land is next to the perennial rivers.

### 5.4.2 Geomorphology

In the exam, you may be asked questions such as:

1. In which direction does the river flow?

**Hint** Determine the height of the river at each point where it starts and ends on the map. A river flows downhill, so it flows from the highest point to the lowest point.

Look at the tributaries that join the main river. The direction in which tributaries join the main river follows the same direction in which the river is flowing.

2. Identify the drainage pattern of the river.

**Hint** Determine the pattern of the river system. Is it a dendritic, radial or trellis pattern? Refer to Figure 2.9A to C on page 35 showing drainage patterns in Chapter 2: Geomorphology.

3. Determine the underlying rock structure of an area.

**Hint** Determine the drainage pattern in the area. The causes of a drainage pattern tell you the kind of rock in the area. For example, if there is a dendritic drainage then the underlying rocks are either horizontal sedimentary rock, igneous or metamorphic rock. Refer to Figure 2.9A to C on page 35 showing drainage patterns in Chapter 2: Geomorphology.

4. In which stage (course) is the river?

**Hint** Determine the steepness of the sides of the valley and the steepness of the river course. A very steep valley is V-shaped and has a steep gradient. This is where the upper course of a river is found. In contrast, if you find a wide floodplain (flat area alongside a river), meanders, marshes or vleis, and oxbow lakes, this is where the lower course of a river is found.
5. Identify the structural landforms.

**Hint**

Look at the form or shape of the contours to identify the following:

**Horizontal strata** – mesa, butte, conical hill: Determine if you have a hill structure (circular contours where the height is increasing towards the centre). Next, study the slope of the hill. In the case of a mesa, the slope is gentle at first (contours far apart) and then the slope becomes very steep (contours close together). At the top of the hill it is flat (there are very few contours and they are spaced far apart). Down the other side of the hill, the slope is very steep (contours close together) and the slope then becomes more gentle (contours far apart) as you move down the other side of the mountain. Refer to Figure 2.23B on page XX showing a contour map of a mesa in Chapter 2: Geomorphology.

**Inclined strata** – homoclinal ridges: Determine if the ridge has a steep slope (contours close together) and a gentle slope (contours further apart). A homoclinal ridge has a scarp (steep) slope and a dip (gentle) slope. Refer to Figure 2.25B on page 47 showing a contour map of an inclined ridge in Chapter 2: Geomorphology.

**Exams**

For more questions that apply theory to a topographic map or orthophoto, refer to the following national Geography exam papers:

- Geography Paper 2 February/March 2012 – PAARL, 1.3
- Geography Paper 2 November 2011 – PAARL, 1.7; 3.11; 3.3; 3.4.3; 3.4.1 & 3.4.2
- Geography Paper 2 February/March 2011 – HUMANSDORP, 2.1
- Geography Paper 2 November 2010 – HUMANSDORP, 3.1; 3.7; 3.8
5.5 Geographical information systems - GIS

GIS is an organised collection of computers, computer programmes, geographic data and people. This definition gives you the components that make up GIS: People who know how to use computers (hardware) and programmes (software) to provide information (from geographic data) are able to solve a problem or answer a specific question.

Key concepts

<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Components of GIS</td>
<td>Hardware (computers), software (computer programmes), data (information), people, procedures (how to solve a problem or answer a question), network (where to get the information from).</td>
</tr>
<tr>
<td>Spatial data</td>
<td>Spatial data refers to the position of an object, in other words, its co-ordinates. For example, the spatial data for a tree could be: 29°30,3' S; 19°10,8' E</td>
</tr>
<tr>
<td>Attribute data</td>
<td>Attribute data is information that describes or give the characteristics of an object. For example, the attribute data for a tree could be: It is an acacia tree, which is 5 m tall.</td>
</tr>
<tr>
<td>Vector data</td>
<td>Spatial data stored in the form of co-ordinates, shown as point, line or polygon features.</td>
</tr>
<tr>
<td>a) Point features</td>
<td>Point features on a map include spot height, buildings and trig. stations.</td>
</tr>
<tr>
<td>b) Line features</td>
<td>Line features on a map include rivers, roads and walls.</td>
</tr>
<tr>
<td>c) Polygon features</td>
<td>Polygon features on a map include cultivated land, built-up areas and dams.</td>
</tr>
</tbody>
</table>

**NB!**

In a mapwork exam, you may be asked to identify a point, line or polygon feature on a map. Look at the conventional signs shown in the block (referred to in the question).
- Point features are indicated by a circle (e.g. spot height), triangle (e.g. trig. station), square (e.g. building, post office), rectangle (e.g. factory) or a single object (wind pump, dipping tank).
- Line features are indicated by a straight line (e.g. farm boundary, wall) or a curved line (e.g. rivers, roads and railways).
- A polygon feature is any sign that takes up more space than a single feature, for example, a dam, cultivated land, built-up area or golf course.
### Buffering

To demarcate (mark off) an area around an object. The marked-off area is the buffer zone. Buffer zones often protect people from living in a dangerous area.

For example, along a river people should live above the 50-year flood line. The 50-year flood line is the height below which the river floods. The area below the 50-year flood line is the buffer zone for this area. If you live in the buffer zone your home is likely to be affected when the river floods. If you take notice of the buffer zone and live above the 50-year flood line, your home is likely to be safe when the river floods.

Figure 5.12 below shows how point, line and polygon features have buffer zones placed around them.

![Buffering a linestring](image1.png)

![Buffering a point](image2.png)

![Buffering a polygon with one interior ring](image3.png)

![Buffering a multipoint](image4.png)

**Figure 5.12: Buffer zones**

### Raster data

Spatial data stored in the form of pixels. Pixels are similar to the blocks found on a topographic map (e.g. block A3). The size of the pixel (block) will determine in how much detail an area will be shown. Smaller pixels show more detail. Larger pixels show less detail.

### Remote sensing

Taking a picture of something from far away, for example from a satellite

### Spatial resolution

How clear and easy the detail is to see

### Data or thematic layering

When different kinds of information are placed one on top of the other to see the overall picture.

For example, on the Nelspruit map, the layers of data needed to draw block D1 are:

- Vegetation
- Contour lines
- Roads
- Power lines
- Built-up areas
- Water

Figure 5.13 illustrates the idea of data layering.

![Data layering](image5.png)

**Figure 5.13: Data layering**
Activity 5.9

Refer to the topographic map 2530BD Nelspruit and the orthophoto map extract at the back of this study guide to answer the following questions.

1. Underline the correct term that matches the description below:
   a) Data that refers to the actual position of an object is vector/raster data. (1 x 2 = 2)
   b) Data that is stored in pixels is vector/raster data. (1 x 2 = 2)

2. Refer to block B1 on the 2530BD Nelspruit topographic map. Give an example from this block of the following:
   a) Point feature (1 x 2 = 2)
   b) Line feature (1 x 2 = 2)
   c) Polygon feature (1 x 2 = 2)

3. List any four layers that were used to draw this topographic map. (4 x 2 = 8)

Answers to activity 5.9

1. a) Data that refers to the actual position of an object is vector/raster data. (2)
   b) Data that is stored in pixels is vector/raster data. (2)

2. a) Point feature: spot height/farmstead/tree (any 1) (2)
   b) Line feature: contour/power line/track or hiking trail/road/dam wall/river (perennial or non-perennial)/furrow (any 1) (2)
   c) Polygon feature: woodland/cultivated land/orchards/excavations (any 1) (2)

3. The following layers were used to draw the topographic map:
   - Woodland – all the farming land and woodland areas (2)
   - Height – the brown contour lines (2)
   - Water – all the rivers and the perennial water and furrows (2)
   - Transport – roads and track/hiking trail (8)

Exams

For more questions on GIS, refer to the following national Geography exam papers:
- Geography Paper 2 February/March 2012 – PAARL, Question 4
- Geography Paper 2 November 2011 – PAARL, Question 4
- Geography Paper 2 February/March 2011 – HUMANSDORP, Question 4
- Geography Paper 2 November 2010 – HUMANSDORP, Question 4

You are there, well done!
Appendix: Past Grade 12 exam papers

In this section you will find four sets of exams and related documents. The first set relates to Geography Theory (Paper 1). The following three sets of documents relate to Mapwork (Paper 2).

Geography Theory: Paper 1

- Grade 12 National Geography Paper 1 from February/March 2012 (pages 167 – 173)
- Grade 12 National Geography Paper 1 annexure from February/March 2012 (pages 174 – 179). The annexure contains images and diagrams that you will need to answer the questions in the exam (Paper 1)
- Grade 12 National Geography Paper 1 marking memorandum from February/March 2012 (pages 180 – 187)

Geography Mapwork: Paper 2

1) Grade 12 National Geography Paper 2 from November 2011 (pages 188 – 193)
   To answer these Mapwork exam questions, you will need to refer to topographical map 3318DB PAARL and orthophoto map 3318DB 25 PAARL. You will find these two maps in the Map Folder at the back of this study guide.
   - Grade 12 National Geography Paper 2 marking memorandum from November 2011 (pages 194 – 199)

2) Grade 12 National Geography Paper 2 from February/March 2010 (pages 200 – 205)
   To answer these Mapwork exam questions, you will need to refer to topographical map 2230AA&AC MUSINA and orthophoto map 2230 AC 11 MUSINA SOUTH. You will find these two maps in the Map Folder at the back of this study guide.
   - Grade 12 National Geography Paper 2 marking memorandum from February/March 2010 (pages 206 – 210)

3) Grade 12 National Geography Paper 2 from November 2010 (pages 211 – 216)
   To answer these Mapwork exam questions, you will need to refer to topographical map 3424BB HUMANSDORP and orthophoto map 3424 BB 1 HUMANSDORP. You will find these two maps in the Map Folder at the back of this study guide.
   - Grade 12 National Geography Paper 2 marking memorandum from November 2010 (pages 217 – 222)

Use these exam papers, marking memoranda and maps to help you prepare for your exams:

1. **Answer the questions** in each of the four exams (one Geography Theory and three Geography Mapwork exams). Make sure you have enough of a break between each one so that you are not too tired to think properly.

2. Treat each one as a ‘real’ exam by making sure you have all the materials you need (pens, pencils, eraser, protractor, compass and calculator). **Time yourself** so you complete Geography Paper 1 within 3 hours; and each of the Geography Paper 2 exams within 1 ½ hours.

3. This exercise is meant to test your knowledge – so don’t cheat yourself by looking up the answers provided in the marking memoranda before you’ve finished each exam.

4. Use the memoranda to check whether or not your answers are correct. Note where you have got answers wrong – these are the sections of the curriculum that you need to do more work on. Go back to your textbooks and to the relevant sections of this study guide. **Spend time learning** the sections for which you got the lowest marks.

5. Remember: success at Mapwork depends on **practise, practise, practise, and then more practise**! That is why you have been provided with three Mapwork exams (Paper 2). Complete each one of them over and over again, until you get most of the questions rights. That way you will fly in your year-end exams!
INSTRUCTIONS AND INFORMATION

1. This question paper consists of FOUR questions.
2. Answer ANY THREE questions of 100 marks each.
3. ALL diagrams are included in the ANNEXURE.
4. Number ALL your answers in the CENTRE of the line.
5. Leave a line between subsections of questions answered.
6. Start EACH question at the top of a NEW page.
7. Number the answers correctly according to the numbering system used in this question paper.
8. Do NOT write in the margins of your ANSWER BOOK.
9. ENOCIRCLE the numbers of the questions that you have answered on the front page of your ANSWER BOOK.
10. Where possible, illustrate your answers with labelled diagrams.
11. Write clearly and legibly.
SECTION A: CLIMATE AND WEATHER, FLUVIAL PROCESSES AND STRUCTURAL LANDFORMS

Answer at least ONE question from this section.

QUESTION 1

1.1 FIGURE 1.1 illustrates air pressure belts over Africa. Answer the questions below by matching each question with a term from the list below. Write only the word(s) next to the question number (1.1.1–1.1.5) in the ANSWER BOOK.

ITCZ, subtropical, easterlies, Coriolis, Hadley, polar easterlies

1.1.1 Name the pressure belt South Africa is located in. (2)

1.1.2 What is the name of the belt where the tropical easterlies converge? (2)

1.1.3 What is the name of the force that deflects winds to the left in the Southern Hemisphere? (2)

1.1.4 Name the winds that diverge from the 30°N/S latitude. (2)

1.1.5 Identify the name of the cell associated with warm rising air at the equator. (2)

1.2 Refer to FIGURE 1.2 which shows fluvial features and give ONE term for each of the statements below:

1.2.1 Water that flows on the surface after it rains (1 x 2)

1.2.2 High-lying area that separates two different drainage basins (1 x 2)

1.2.3 Water found below the Earth’s surface (1 x 2)

1.2.4 Point where the river enters the sea. (1 x 2)

1.2.5 Shows the division between tributaries in the same drainage basin (5 x 2)

1.3 Study FIGURE 1.3 which shows a cross section through a line thunderstorm which develops along a moisture front/trough line.

1.3.1 Explain the meaning of the term moisture front. (1 x 2)

1.3.2 Identify the two winds at A and B that will converge at the moisture front. (2 x 2)

1.3.3 Indicate which ONE of the two winds mentioned above is warm and moist and which one is cold and dry. (2 x 2)

1.3.4 Explain why the two winds identified in QUESTION 1.3.2 show different characteristics in terms of moisture content and temperature. (2 x 2)

1.3.5 Briefly describe how a thunderstorm develops along the moisture front. (3 x 2)

1.3.6 State TWO ways in which line thunderstorms can impact negatively on farming activities in the South African interior. (2 x 2)

1.4 Study FIGURE 1.4 which shows a seasonal wind in India.

1.4.1 Identify the seasonal wind shown in the sketch. (1 x 2)

1.4.2 Why is it called a seasonal wind? (1 x 2)

1.4.3 Identify the season represented in FIGURE 1.4. (1 x 2)

1.4.4 Although people fear the arrival of the seasonal wind shown in FIGURE 1.4, they are more concerned with the late arrival of the seasonal wind. Explain this statement in full. (6 x 2)

1.5 Refer to FIGURE 1.5 showing a river basin.

1.5.1 Name the type of river labelled A. (1 x 2)

1.5.2 Determine the stream order at B. (1 x 2)

1.5.3 Explain how the forested area will affect stream discharge (run-off). (2 x 2)

1.5.4 Identify the drainage pattern evident in the area called Cap Mountains. (1 x 2)

1.5.5 River capture has occurred at point C.

(a) Explain the concept river capture. (1 x 2)

(b) Suggest TWO characteristics that River Ron would have in order to have captured another river. (2 x 2)

(c) What impact does river capture have on settlement D that occurs along the multi-river? (2 x 2)
1.6 Study FIGURE 1.6 which depicts a side view of a river.

1.6.1 Identify the river profile labelled A. (1 x 2) (2)

1.6.2 Give TWO possible reasons for the rain water not soaking
(infiltrating) into the ground fast enough. (2 x 2) (4)

1.6.3 Flooding of rivers is largely due to river mismanagement. Write a paragraph (approximately 12 lines) suggesting ways in which humankind mismanages river environments. (6 x 2) [100]

QUESTION 2

2.1 Refer to FIGURE 2.1 which shows a mid-latitude cyclone. Respond to each of the statements below by matching them to the terms provided. Write only the word(s) next to the question number (2.1.1–2.1.5) in the ANSWER BOOK.

- Warm front
- Cumulonimbus
- Citrus
- Cold front
- Occlusion
- Polar front

2.1.1 Identify the front labelled A. (2)

2.1.2 State the type of cloud associated with the approach of a mid-latitude cyclone. (2)

2.1.3 Name the thunderstorm cloud associated with front A. (2)

2.1.4 The term used to describe the process when a cold front catches up with the warm front at the apex (C). (2)

2.1.5 Identify the front D which rarely affects the weather of South Africa. (2)

2.2 Study FIGURE 2.2 which shows fluvial features. Choose the correct word(s)/term(s) from those given in brackets. Write only the word(s)/term(s) next to the question number (2.2.1–2.2.5) in the ANSWER BOOK.

2.2.1 Name the slope that forms on the river labelled X. (Undercut slope/Scarp slope) (2)

2.2.2 The name of the slope labelled Y. (Dip slope/Slip off slope) (2)

2.2.3 Feature E that forms when a meander loop is cut off. (Oxbow lake/Meander neck) (2)

2.2.4 Deposits (F) that occur on the banks of a river. (Silt/Scree) (2)

2.2.5 Area adjacent to the river that floods (G) when a river overflows its banks. (Levee/Flood plain) (5 x 2) (10)

2.3 FIGURE 2.3 is a cartoon that highlights climate hazards and human response.

2.3.1 Suggest a possible cause for the climatic hazards mentioned in the cartoon. (1 x 2) (2)

2.3.2 What message do you think is being conveyed (bold) by the words Whether or not it rains tomorrow isn’t what we should be worrying about? (1 x 2) (2)

2.3.3 What could cause coastal flooding? (1 x 2) (2)

2.3.4 Explain how droughts are likely to lead to an ‘economic collapse’. (2 x 2) (4)

2.3.5 International summits like the Kyoto Protocol and the Copenhagen Accord acknowledged climate change as one of the greatest challenges being experienced. Discuss measures that can be employed to address climate change. (Your discussion should be approximately 12 lines.) (6 x 2) (12)

2.4 Refer to FIGURE 2.4 showing a heat island.

2.4.1 Explain what is meant by the term heat island. (1 x 2) (2)

2.4.2 Calculate the difference in temperatures experienced between the city centre and the outskirts. (1 x 2) (2)

2.4.3 Suggest THREE reasons for the difference in temperature experienced between the city centre and the outskirts. (3 x 2) (6)

2.4.4 Explain why pollution concentration over the city centre will be higher during winter. (2 x 2) (4)

2.4.5 Assess the impact that heat islands will have on the health of people living in the city. (3 x 2) (6)

2.5 Refer to FIGURE 2.5 showing the geology of a particular area.

2.5.1 Does the diagram show tilted/inclined or horizontal strata? (1 x 2) (2)

2.5.2 The hill is an example of a hogback (‘hogsback’).

(a) Name the types of slopes labelled A and B. (2 x 2) (4)

(b) Give an explanation for the steepness of slope A. (2 x 2) (4)

2.5.3 Explain why these landscapes are of little value to humans. (2 x 2) (4)

2.5.4 Explain why the hogback (‘hogsback’) will most likely not develop in the Karoo region of South Africa. (1 x 2) (2)
2.6  FIGURE 2.6 shows a mesa.

2.6.1  Name the slope forms/elements labelled A and B  
(2 x 2)  (4)

2.6.2  Briefly describe how mesas form.  
(2 x 2)  (4)

2.6.3  State ONE characteristic of mesas.  
(1 x 2)  (2)

2.6.4  A typical slope has four slope elements. Using FIGURE 2.6, discuss the significance of these slope elements to human activities.  
(0 x 2)  (12)  [190]

SECTION B: PEOPLE AND PLACES: RURAL AND URBAN SETTLEMENTS, PEOPLE AND THEIR NEEDS

Answer at least ONE question from this section.

QUESTION 3

3.1  Refer to FIGURE 3.1 illustrating the location of towns in relation to each other and answer the questions below.

3.1.1  Give the term used to describe a large urban area where several towns are joined together.  
(2)

3.1.2  Identify the rural settlement evident in the sketch.  
(2)

3.1.3  Will the sphere of influence of town X or Y be greater?  
(2)

3.1.4  Give the name of the theory that explains the relative size and spacing of settlements.  
(2)

3.1.5  What is the term used to describe the trade and transport town X, where a number of routes converge?  
(2)

3.2  Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–G) next to the question number (3.2.1–3.2.5) in the ANSWER BOOK, for example 3.2.1 H.

<table>
<thead>
<tr>
<th>COLUMN A</th>
<th>COLUMN B</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.1 Over-concentration of industries in a few core areas</td>
<td>A  heavy industries</td>
</tr>
<tr>
<td>3.2.2 The largest industrial core area in South Africa</td>
<td>B  footloose industries</td>
</tr>
<tr>
<td>3.2.3 Industries that can locate anywhere due to improved technology</td>
<td>C  market-orientated</td>
</tr>
<tr>
<td>3.2.4 Industries that must be close to consumers</td>
<td>D  centralisation</td>
</tr>
<tr>
<td>3.2.5 These industries are associated with high noise and pollution</td>
<td>E  Durban-Pinetown</td>
</tr>
<tr>
<td></td>
<td>F  Gauteng/PYVV</td>
</tr>
<tr>
<td></td>
<td>G  decentralisation</td>
</tr>
</tbody>
</table>

(5 x 2)  (10)
3.3 Study FIGURE 3.3 which shows different settlements and land uses.

3.3.1 Identify the type of rural settlement labelled 3. Give a reason to support your answer. (2 x 2) (4)

3.3.2 A regional shopping centre is planned for the site labelled 4. Give ONE characteristic of this type of centre. (1 x 2) (2)

3.3.3 Give a reason that could have influenced the site of settlement 5. (1 x 2) (2)

3.3.4 Name ONE factor that favours the location of the industrial area at 1. (1 x 2) (2)

3.3.5 The urban area 2 is associated with a number of challenges. With specific reference to urban area 2, name and discuss (approximately 12 lines) the problems it will experience in terms of urban expansion. (6 x 2) (12)

3.4 FIGURE 3.4 shows migration in developing countries.

3.4.1 Describe the type of migration evident on the sketch. (1 x 2) (2)

3.4.2 Give THREE reasons why people are attracted to cities. (3 x 2) (6)

3.4.3 Assess the impact of rural depopulation on urban areas. (3 x 2) (6)

3.4.4 Explain the impact that HIV/AIDS has on the South African rural landscape. (2 x 2) (4)

3.5 Refer to FIGURE 3.5 which shows the employment structures of two countries.

3.5.1 What is a primary economic activity? (1 x 2) (2)

3.5.2 How are primary and secondary activities linked? (1 x 2) (2)

3.5.3 Match graphs X and Y to:
(a) A developed country (1 x 2) (2)
(b) A developing country (1 x 2) (2)

3.5.4 Explain why country X is likely to have a low GDP. (1 x 2) (2)

3.5.5 Refer to any ONE of the industrial areas that you have studied and write a paragraph (approximately 12 lines) on its location in terms of access to raw materials, transport and markets. (8 x 2) (12)

3.6 Refer to the cartoon in FIGURE 3.6 which focuses on environmental injustice.

3.6.1 What does the term environmental injustice mean? (1 x 2) (2)

3.6.2 Identify the environmental injustice being discussed in the cartoon. (1 x 2) (2)

3.6.3 Do you agree with the solution presented in the cartoon on how to handle the environmental injustice issue discussed here? Explain your answer. (2 x 2) (4)

3.6.4 Give TWO natural reasons for water being a critical resource in South Africa. (2 x 2) (4)

3.6.5 With reference to the TUGA (Tugela-Vaal) project, explain the benefits it brings to the Gauteng economy. (3 x 2) (6)

QUESTION 4

4.1 Refer to FIGURE 4.1 and match the sketches to the descriptions below.

4.1.1 Side view of a city (2)

4.1.2 Linear settlement that develop along a river (2)

4.1.3 Stellar-shaped settlement that develops due to growth along radiating transport lines (2)

4.1.4 A planned irregular street pattern (2)

4.1.5 Settlement that assumes a circular shape (2)

4.2 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (4.2.1–4.2.5) in the ANSWER BOOK, for example 4.2.6 B.

4.2.1 The difference in value between a country's imports and its exports is...
   A an unfavourable trade balance.
   B the balance owing.
   C the balance of payments.
   D the balance of trade.

(2)
4.2.2 If there are no barriers to the import/export of goods and services between countries, we refer to this as ...  
A. open trade  
B. fair trade  
C. free trade  
D. protected trade.

4.2.3 Restrictions placed on the quantity of goods imported into a country are referred to as ...  
A. tariffs  
B. quotas  
C. trading blocks  
D. import substitution.

4.2.4 Activities concerned with the provision of services to consumers are ...  
A. Tertiary  
B. Quaternary  
C. Primary  
D. Secondary.

4.2.5 A strategy adopted by the government in 1994 to solve social and economic problems in South Africa is ...  
A. Asgisa  
B. BEE  
C. GEAR  
D. RDP.

4.3 FIGURE 4.3 shows an urban land-use model.

4.3.1 Which land-use model does the sketch resemble?  
(1 x 2)  
(2)

4.3.2 Refer to the land-use zone labelled A.  
(a) Name the land-use zone.  
(1 x 2)  
(2)  
(b) Describe the location of the zone.  
(1 x 2)  
(2)  
(c) Why is the shape of zone A unrealistic?  
(1 x 2)  
(2)

4.3.3 Give TWO reasons for the development of shanty towns.  
(2 x 2)  
(4)

4.3.4 Suggest TWO challenges associated with shanty town settlements.  
(2 x 2)  
(4)

4.3.5 Which aspect of the model typically resembles a South African city?  
(1 x 2)  
(2)

4.4 Currently many people are living in cities with a population of more than 5 million. Urbanisation is still taking place and cities are continuously growing.

4.4.1 Define the term urbanisation.  
(1 x 2)  
(2)

4.4.2 Is urbanisation at present greater in developing countries or developed countries? Give a reason why this is the case.  
(2 x 2)  
(4)

4.4.3 Give TWO reasons for rapid urbanisation in the above-mentioned parts of the world.  
(2 x 2)  
(4)

4.4.4 Green belts have an important role to play in preventing urban sprawl. Write a paragraph (approximately 12 lines) to explain the concept of green belts and assess some of the advantages of establishing them in cities.  
(6 x 2)  
(12)

4.5 Read the extract below on food security and answer the questions that follow.

ACHIEVING FOOD SECURITY IN AFRICA: CHALLENGES AND ISSUES

While the rest of the world has made significant progress towards addressing issues related to food security, sub-Saharan Africa continues to lag behind. Preventative measures are urgently needed, as food security has been dropping from 1970. The proportion of malnourished people ranges between 33% and 35%. Over 70% of food supplies are smallholder farmers. Many factors contribute to a food insecure population ...  

(Adapted: Angela Mwani, Cornell University US)

4.5.1 Explain the term food security.  
(1 x 2)  
(2)

4.5.2 Africa has a very high percentage of subsistence farmers. Assess how this will impact on food production.  
(2 x 2)  
(4)

4.5.3 Explain TWO environmental factors that led to food insecurity in southern Africa.  
(2 x 2)  
(4)

4.5.4 Genetically modified crops are seen by many as solutions to food insecurity. Substantiate your viewpoint on this debate.  
(6 x 2)  
(12)

4.6 Refer to FIGURE 4.8 on street trading and answer the questions below.

4.6.1 Give another name for street trading.  
(1 x 2)  
(2)

4.6.2 Explain why street trading is seen to be part of the 'hidden economy'.  
(2 x 2)  
(4)
4.6.3 Describe the problem being experienced by street traders in the context.

4.6.4 Suggest TWO measures that can be put in place to increase the contribution of this type of trading to the economy of South Africa.

4.6.5 Why is street trading mainly a characteristic of developing countries?

4.6.6 Explain why this type of trade is important to developing countries.

GRAND TOTAL: [190]
This annexure consists of 11 pages.
SECTION A

QUESTION 1

1.1 1.1.1 Subtropical belt (2)
1.1.2 ITGZ (2)
1.1.3 Corolis (2)
1.1.4 Westerlies (2)
1.1.5 Hadley (2)

(5 x 2) (10)

1.2 1.2.1 Surface flow (2)
1.2.2 Watershed (2)
1.2.3 Ground water (2)
1.2.4 River mouth (2)
1.2.5 Interfluve (2)

(5 x 2) (10)

1.3 1.3.1 It is a zone between two air masses with different moisture content (2)

(1 x 2) (2)

1.3.2 A is the south westerly wind (2)
B is the north easterly wind (2)

(2 x 2) (4)

1.3.3 A is cold (2)
B is warm (2)

(2 x 2) (4)

1.3.4 A originates from the Atlantic Ocean which is cold (2)
B originates from the Indian Ocean which is warm (2)

(2 x 2) (4)

1.3.5 The cold dry south westerly wind and the warm north easterly wind converge at the moisture front (2)
The cold, dry south westerly wind sinks whilst the warm, moist air rises along the front (2)
Air will therefore cool and condense forming cumulonimbus clouds which will result in heavy rainfall along the front (2)
[Any THREE] (3 x 2) (6)

1.3.6 Cause floods which will sweep away crops (2)
Accompanied by hail which may damage crops (2)
Lightning could start a fire (2)
[Any TWO] (2 x 2) (4)
1.4.1.1 Monsoon wind (2) (1 x 2) (2)

1.4.2 The direction of the surface wind is reversed in winter and summer (2)
- The wind operates in the hot (summer) and cold (winter) season (2)
- Derived from Arabic word ‘meusuim’, which means season (2)
  [Any ONE] (1 x 2) (2)

1.4.3 Summer (2) (1 x 2) (2)

1.4.4 Arrival results in flooding (2)
- results in destruction of infrastructure (2)
- results in loss of personal property (2)
- results in spreading of diseases (2)
  Late arrival: absence of much needed rain (2)
    - causes drought (2)
    - crops will die (2)
    - livestock will die (2)
    - decrease in food production (2)
    - famine (2)
    - negative impact on food security (2)
    - economy declines (2)
    - the country affected will have to import food (2)

[Any SIX. Candidates must refer to both parts of the question] (6 x 2) (12)

1.5.1.1 Non-perennials/periodic/seasonal (2) (1 x 2) (2)

1.5.2 Third order (2) (1 x 2) (2)

1.5.3 Will reduce discharge (2)
- It intercepts precipitation (2)
  - It adds to the rates of evapo-transpiration (2)
  - Roots of plants take up water, reducing through-flow (2)
  [Any TWO] (2 x 2) (4)

1.5.4 Dendritic (2) (1 x 2) (2)

1.5.5 (a) Where one river captures/robs the headwaters of another river
  and so increases the size of its drainage basin (2) (1 x 2) (2)

(b) Steeper gradient (2)
  - Greater rainfall (2)
  - Softer rock (2)
  - Lower flow level (2)
  [Any TWO] (2 x 2) (4)

(c) Less water available for agriculture (2)
- Less deposition therefore drop in soil fertility (2)
- Decrease in production (2)
- Economic decline (2)
- Lower volumes of water available for domestic and industrial use (2)
- Aquatic organisms perish since the supply of water is reduced (2)
- Food chains and food webs are disrupted (2)
  [Any TWO] (2 x 2) (4)

1.6.1.1 Cross profile/transverse (2) (1 x 2) (2)

1.6.2 Heavy rains (2)
- Steep slope (2)
- Ground almost saturated (2)
- Rock with low porosity (2)
- Low degree of permeability of rocks (2)
- Lack of vegetation (2)
  [Any TWO] (2 x 2) (4)

1.6.3 WAYS IN WHICH HUMANKIND MISMATCHES RIVERS

Deforestation (2)
- Discharge of sewage and industrial waste (2)
- Overirrigation (2)
- More settlements in drainage basins because of population increase (2)
- Overcultivation (2)
- Overgrazing (2)
- Chemicals used in agriculture washed away by surface runoff (2)
- The construction of dams decreases volume of water further downstream (2)
- River ecosystems thrown in imbalance (2)

[Any SIX. Accept other reasonable answers] (6 x 2) (12)
QUESTION 2

2.1

2.1.1 Cold front (2)
2.1.2 Cirrus (2)
2.1.3 Cumulonimbus (2)
2.1.4 Covid (2)
2.1.5 Warm front (2)

2.2

2.2.1 Under cut slope (2)
2.2.2 Slip off slope (2)
2.2.3 Oxbow lake (2)
2.2.4 Silt (2)
2.2.5 Flood plain (2)

2.3

2.3.1 Greenhouse effect (2)
Climate change (2)
Global warming (2)
[Any ONE] (1 x 2) (2)

2.3.2 The short-term effects of climate change is of no concern, but rather the long-term effects and the cause of it (2)
Climate change will negatively affect the economy (2)
[Any ONE] (1 x 2) (2)

2.3.3 Storms surges (2)
Tsunamis (2)
Melting of ice caps (2)
[Any ONE] (1 x 2) (2)

2.3.4 Loss of crops (2)
Less exports (2)
Less foreign capital (2)
Negative balance of trade (2)
Imports of agricultural products (2)
[Any TWO] (2 x 2) (4)

2.3.5 MEASURES TO ADDRESS CLIMATE CHANGE

Concerted effort to reduce greenhouse emissions (2)
Legislation to restrict emissions (2)
Investigating the viability of renewable energy sources (2)
Private funding to develop renewable energy (2)
Direct control of emissions from waste (methane and transport sectors (fossil fuels))(2)
Prevent deforestation (2)
Practising forestation for trees to absorb carbon dioxide (2)
Promote sustainable forms of agriculture (2)
Public awareness campaigns (2)
Educating public in schools (2)
[Any SIX. Accept other reasonable answers] (6 x 2) (12)

2.4

2.4.1 A region of higher temperatures in an urban area surrounded by lower temperatures in the rural areas (2)
[Concept] (1 x 2) (2)

2.4.2 6°C (2)

2.4.3 Tall buildings which cause sun rays to be reflected and deflected (2)
Artificial material used in construction of buildings which helps to retain more heat (2)
More heat-generating activities such as restaurants, hotels, etc. in cities (2)
Vehicles and industries increase the production of pollutants that absorb and retain heat for longer (2)
The high density of tall buildings reduces the flow of air in the city and temperatures remain high (2)
Efficient drainage system removes water from the surface quickly, reducing the rate of evaporation causing the atmosphere to be hot (2)
Household heating systems (2)
Higher population (2)
There is less vegetation, therefore less heat is used for transpiration and photosynthesis (2)
Buildings create a larger surface area that is heated (2)
[Any THREE] (3 x 2) (6)

2.4.4 The city cools and dense air sinks (2)
Flow of air from the surrounding rural area is not so strong (2)
The warm polluted air is prevented from escaping into the upper atmosphere by the strong inversion conditions (2)
The dust dome or heat island is strongly developed (2)
Artificial heating (2)
[Any TWO] (2 x 2) (4)

2.4.5 People suffer from respiratory diseases (2)
Allergies, e.g. irritation of the eyes and skin disorders (2)
Heat stress may result in heart ailments that could result in death amongst the elderly (2)
Smog and fog reduces visibility increasing the incidence of accidents amongst motorists (2)
More condensation which causes more rainfall over a city resulting in flooding and drowning (2)
[Any THREE. Accept other reasonable answers] (3 x 2) (6)
2.5 Inclined (titled) strata (2)

2.5.1 A - Scarp slope (2)

2.5.2 B - Dip slope (2)

2.5.3 Higher angle of inclination (2)
Resistant rock does not erode easily (2)

2.5.4 Horizontal strata/layered found in the Karoo (2)

2.6 A - Crest (2)
B - Cliff/escarp slope/free face (2)

2.6.2 Elevate plateau exposed to erosion by running water (backwasting) (2)
Reduced in size (cut up) into larger, free standing blocks (2)
Mesas is formed when a plateau is reduced in size due to erosion by running/water (2)
The caprock is reduced from the sides (2)
Backwasting occurs (2)
Slope retains the height (2)
Parallel retreat of slopes (2)
Ultimate the height of the feature is greater than the diameter (2)

2.6.3 The diameter is larger than the height (2)
It has steep slopes (2)
A cap of hard rock protects the soft rock underneath (2)
It is typically associated with all four slope elements (2)

2.6.4 CLIFF

2.6.5 Rock climbing and abseiling activities (2)

THE PEDIMENT

2.6.6 Gentle/low angle slope ideal for human settlement (2)
Easy to construct roads and other infrastructure (2)
Farming activities on pediment (2)
Low rainfall and thin soil layer in Karro only suitable for sheep/goat farming (2)

2.6.7 CREST

Resistant layer not suitable for human use (2)

TALUS

Little human use due to steep angle and unweathered material (2)

LANDSCAPE IN GENERAL

Ideal for photography (2)
Survey for water trapped between sedimentary layers (2)
Karoo ideal for satellite dishes due to clear skies (2)

[Any SIX. Accept other reasonable uses] (6 x 2) (12)
3.4 Rural-urban migration (2)

3.4.1

(1 x 2) (2)

3.4.2

More job opportunities (2)

More permanent jobs (2)

Greater scope for promotion (2)

Superior social amenities (2)

Better educational facilities (2)

Better housing (2)

Availability of clean and pure water (2)

Efficient transport system (2)

Health and medical services are readily available (2)

Lack of security on farms (2)

[Any TWO]

(1 x 2) (2)

3.4.3

Lack of housing (2)

Growth of informal settlements (2)

Increase in levels of crime (2)

Unskilled people cannot find jobs (2)

Traffic congestion and pollution increases (2)

Insufficient services to cope with large population (2)

Waste management becomes uncontrollable (2)

Hygiene is a problem in informal settlements (2)

Lack of purified water and sewage facilities in informal settlements (2)

Values, traditions and customs break down when people get caught up in city life (2)

Overcrowding and lack of shelter leads to the rapid spread of diseases such as TB (2)

[Any THREE]

(3 x 2) (6)

3.4.4

Increased medical costs and reduced ability to work (2)

To meet daily expenses family has to sell livestock and other assets including land (2)

Other members of the family also spend more time caring for the Aids patient and spend less time on farming (2)

Child labour increases where children are taken out of school (2)

Results in shortage of food and poverty because of decreased family income (2)

The family becomes socially excluded due to the stigma attached to HIV/AIDS (2)

Death of women as care givers have a severe impact (2)

Child-headed households (2)

HIV/AIDS patients cannot meet the demands of labour intensive subsistence farming (2)

Households limit their cultivation of crops to fields near their farms instead of working for others (2)

Death of young adults will result in higher proportion of elderly and young children in rural areas (2)

[Any TWO]

(2 x 2) (4)

Activity concerned with the extraction of raw materials from the natural environment (2)

[Concept]

(1 x 2) (2)

Primary activities provide raw materials for secondary activities (2)

Secondary activities process the raw material (2)

[Any ONE]

(1 x 2) (2)

A Y (2)

B X (2)

B X (2)

High percentage of primary activities (2)

Lower percentage secondary and tertiary (goods and services) (2)

Fewer finished goods to export (2)

Less contributions to GDP (2)

[Any ONE]

(1 x 2) (2)

PWV/GAUTENG

1. RAW MATERIALS:
Abundant raw materials (2)
Gold, iron-ore and maize (2)
Closer to coal-fired power stations
Produced in close proximity to the industries (2)

2. TRANSPORT:
A dense network of roads and railways (2)
Many airports (2)
It facilitates the distribution of the goods that are manufactured (2)

3. MARKETS:
The population is dense (2)
This creates a growing demand for a variety of goods (2)
Linked to all major towns and cities (2)
Access to overseas markets through harbours (2)
DURBAN-PINETOWN
1. RAW MATERIALS:
   A variety of resources (2)
   Sugar cane, dairy products, meat and subtropical fruit are
   produced in this area (2)
2. TRANSPORT:
   Close to coal-fired power stations in KZN (2)
   Grand transport links to the interior of the country (2)
3. MARKETS:
   Dense population (2)
   Great demand for the manufactured goods (2)
   Easy access to Asian market via the harbour (2)
   Access to inland market (2)

SOUTH WESTERN CAPE
1. RAW MATERIALS:
   Abundant supply of deciduous fruit, grape and fish (2)
   Many food processing industries have been established here (2)
   Little access to coal and power stations (2)
2. TRANSPORT:
   Table Bay facilitates an excellent access for oceanic trade (2)
   The dense rail network provides a vital link to the interior (2)
3. MARKETS:
   Dense population (2)
   There is a large market with a high purchasing power (2)
   Many dependant towns surrounding Cape Town (2)
   The coastal location favours access to a large European market (2)
   Access to inland markets (2)

PORT ELIZABETH-UTENHAGE
1. RAW MATERIALS:
   Abundant raw materials (2)
   Wool, sub-tropical fruit and cotton are readily available (2)
   Little access to coal and power stations (2)
2. TRANSPORT:
   An excellent transport system (2)
   Raw materials can easily be transported here for processing (2)
   Harbour links with overseas market (2)
   Links this region to interior of the country (2)

3. MARKETS:
   Presence of harbour links with overseas market (2)
   Facilitates importing of raw materials and the export of goods (2)
   Access to inland market (2)
   [Any SIX. Candidates must refer to Raw materials, Transport and Markets in ONE industrial area only] (6 x 2) (12)
   3.6 3.6.1
   The environment is abused or treated unfairly in some way (2)
   [Concept] (1 x 2) (2)
   3.6.2
   Nuclear waste disposal in ground water and ocean (2)
   Ecological destruction (2)
   [Any ONE] (1 x 2) (2)
   3.6.3
   No (2)
   Polluting the oceans also causing harm to environment and man (2)
   (2 x 2) (4)
   3.6.4
   Rainfall is low and unreliable (2)
   Rainfall is highly variable (2)
   There are only a few natural lakes (2)
   Most rivers are non-perennial (2)
   Many rivers are silted from soil erosion thus making them shallow (2)
   Evaporation rates are high since the climate is hot and dry (2)
   There are few deep valleys and gorges, therefore the dams built are shallow with larger surface areas that promote evaporation (2)
   [Any TWO] (2 x 2) (4)
   3.6.5
   Sustained economic growth of the region (2)
   Provides clean water to Gauteng (2)
   Use for generation of hydroelecricity (2)
   Supply water for industrial use (2)
   Supply water for municipal use (2)
   Supply of water for agricultural use (2)
   Support recreation facilities such as skiing, boating and camping (2)
   Promotes tourism (2)
   [Any THREE] (3 x 2) (6)
   [100]
QUESTION 4

4.1 4.1.1 E (2)
4.1.2 B (2)
4.1.3 C (2)
4.1.4 D (2)
4.1.5 A (2) (10)

4.2 4.2.1 D (2)
4.2.2 C (2)
4.2.3 B (2)
4.2.4 A (2)
4.2.5 D (2) (10)

4.3 4.3.1 Concentric (accept sector model) (2)
4.3.2 (a) CBD (2)
(b) Central location (2)
(c) Physical obstacles make it impossible to have circular shape (2)

4.3.3 Lack of housing (2)
People want to stay close to work (2)
Expensive transport (2)
Poverty (2)
Unemployment (2)
Overcrowding (2) [Any TWO] (4)

4.3.4 Structures put up not according to municipal regulations (2)
Insanitary (2)
Unhygienic conditions (2)
Pollution (2)
Crime (2)
Social ill (2)
Lack of basic facilities (2)
No open spaces (2) [Any TWO] (4)

4.3.5 Informal settlements on outskirts (2) (1 x 2) (2)

4.4 4.4.1 The percentage of the total population of a region or country that lives in urban areas rather than in rural areas (2) [Concept] (2 x 2) (4)

4.4.2 Developing Countries/LEDGs (2)
Still large percentage of people living in rural areas moving to cities (2)

4.4.3 Rural-urban migration (2)
Natural population growth (2)
Immigrants and refugees from other countries (2) [Any TWO] (4)

4.4.4 DEFINITION OF GREEN BELT
Buffer zone of large open space with gardens (2)

ADVANTAGES OF ESTABLISHING GREEN BELTS IN CITIES:
Reduce level of noise (2)
Add to aesthetic value (2)
Photovoltaic possible (2)
Release oxygen (2)
More clean air (2)
Use carbon dioxide (2)
Thus helps with reduction in pollution levels (2)
Create recreational areas (2)
Protect wild life in cities (2) [Any SIX. Candidates must refer to both Definition and Advantages] (6 x 2) (12)

4.5 4.5.1 Occurs when sufficient food is produced to meet the needs of people (2) [Concept] (1 x 2) (2)

4.5.2 Limits production (2)
More subsistence farming (2)
Usually no surplus production (2)
Land overexploited (2)
Increases soil infertility (2) [Any TWO] (2 x 2) (4)

4.5.3 DROUGHT:
Lack of rain for long spells burns crops and causes them to die (2)
Grazing land for livestock is reduced (2)
Overgrazing leads to the spread of desert conditions (2)

FLOODS:
Fertile topsoil is washed away (2)
Food production thus decreases (2)
Food has to be imported at high prices (2)
Stock farmers suffer heavy losses when valuable grazing lands are destroyed (2)
Shortage of livestock causes food prices to increase (2)

SOIL INFERTILITY:
Soils are thin and infertile in most regions (2)
Poor farming practices like monoculture and cultivating crops in marginal areas
Destroys large tracts of valuable farmland (2) [Any TWO. MUST refer to TWO aspects] (2 x 2) (4)
4.5.4 ADVANTAGES OF USING GENETICALLY MODIFIED CROPS
They have greater pest resistance (2)
They are more resistant to disease (2)
They have greater herbicide tolerance (2)
They have a high level of cold tolerance (2)
They are resistant to drought (2)
They have a high nutritional value (2)
They have a longer storage life (2)
More food per hectare can be produced (2)

DISADVANTAGES OF USING GENETICALLY MODIFIED CROPS
GM seeds have been developed by a few multinational companies that have the monopoly over them (2)
The long-term effects of genetic modification on man's health are unknown (2)
New seeds have to be planted every year and this is costly (2)
The effects on the environment, e.g. food chains, are not known (2)
[Any SIX. Candidates may refer to either Advantages or Disadvantages, if they refer to both, accept] (6 x 2) (12)

4.6
4.6.1 Informal trading (2) (1 x 2) (2)

4.6.2 The contribution of this economic sector to the economy of a country is usually not shown in 'official figures' (2)
The businesses are not registered, therefore they can't pay tax (2)
Employees do not have benefits (2) (2 x 2) (4)

4.6.3 Traders are frequently harassed by local authorities as informal sector activities are considered to be illegal (2)
Informal traders could experience competition (2)
[Any ONE] (1 x 2) (2)

4.6.4 Introduce licensing requirements to regulate this sector (2)
Allocate specific areas near stations, bus terminals and taxi ranks (2)
Partnerships between the private sector and informal traders (2)
Provide permanent structures such as hawker stalls and carts in areas that are zoned for informal trading (2)
Small businesses can play an active role in providing training and improving skills through learnership programmes (2)
Provide easier access to bank loans (2)
Provide storage facilities (2)
[Any TWO] (2 x 2) (4)

4.6.5 Not enough work in formal sector (2)
A slump in the economy that has caused large scale job losses (2)
Mechanisation of farming operations (2)
Increased frequency of climatic hazards (2)
Many large-scale businesses are sub-contracting to the informal sector (2)
[Any ONE] (1 x 2) (2)

4.6.6 Provide a source of income for those that cannot find a job in the formal sector (2)
Reduces crime by creating employment (2)
Goods can be purchased at a lower price (2)
[Any TWO] (2 x 2) (4)
[100]

GRAND TOTAL: 300
QUESTION 1: MULTIPLE-CHOICE QUESTIONS

The questions below are based on the 1:50 000 topographical map 3318DB PAARL, as well as the orthophoto map 3318DB 25 PAARL as part of the mapped area. Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) in the block next to each question.

1.1 The index of the map sheet directly southeast of PAARL is ...
   A  3319AC
   B  3319OC
   C  3319CC
   D  3318BC

1.2 The Earth’s curved surface is represented on the topographical map by the .... projection.
   A  Transversal
   B  Lambert
   C  Mercator
   D  Gauss conform

1.3 Paarl is located in the ...
   A  Western Cape
   B  Northern Cape
   C  Eastern Cape
   D  Free State

1.4 The approximate time that the orthophoto was taken would be ...
   A  between 08:00–10:00
   B  between 10:00–12:00
   C  between 12:00–14:00
   D  exactly at 12:00

1.5 The stream channel feature in block D12 on the topographical map is a/an ...
   A  oxbow lake
   B  braided stream
   C  meander
   D  dendritic pattern

1.6 The man-made water feature at 33°38’24”S 18°52’48”E/33°38’4”S 18°52’8”E is a ...
   A  dam
   B  non-perennial river
   C  river
   D  windmill
1.7 The drainage pattern in blocks F8, G9 and H8 is ...  
A. a trellis  
B. dendritic  
C. rectangular  
D. radial.

1.8 The land-use zone marked 1 on the orthophoto map is ...  
A. the zone of decay  
B. the rural-urban fringe  
C. a high income residential area  
D. an industrial zone.

1.9 The slope marked 2 on the orthophoto map is ...  
A. steep  
B. gentle  
C. concave  
D. convex.

1.10 The building marked 3 on the orthophoto map is ...  
A. school  
B. factory  
C. site  
D. smallholding.

QUESTION 2: GEOGRAPHICAL TECHNIQUES AND CALCULATIONS

2.1 Calculate the gradient between trigonometrical station 172 in block C8 and spot height +162 in block B9. Show ALL calculations. Marks will be allocated for calculations.

2.2.1 Calculate the vertical exaggeration of the cross section above.

2.2.2 Identify the features labelled X and Y on the cross section.
   X:  
   Y:  

2.2.3 Why are cross sections exaggerated?

   (10 x 2) [20]
2.3 Calculate the magnetic declination for the year 2011. Show ALL calculations. Marks will be allocated for calculations.

2.4 Give TWO reasons why the magnetic declination will be useful to a person using a map on a field trip.

QUESTION 3: APPLICATION OF THEORY/ MAP AND PHOTO INTERPRETATION

3.1 Refer to both the topographical map and the orthophoto map when answering the questions below.

3.1.1 Identify the shape of the town Paarl.

3.1.2 Name TWO physical factors that determine the shape of the town Paarl.

3.2 What is the direction of Boland Agricultural College in block C7 from Paarl?

3.3 Compare Dal Josafat (block F12) and Noorder-Paarl (block F11) in terms of the following:

<table>
<thead>
<tr>
<th>DAL JOSAFAT</th>
<th>NOORDER-PAARL</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.1 Main land-use zone</td>
<td></td>
</tr>
<tr>
<td>3.3.2 Land value</td>
<td></td>
</tr>
<tr>
<td>3.3.3 Degree of pollution</td>
<td></td>
</tr>
</tbody>
</table>

(3 x 2)

3.4 Refer to Groenheuwel in block E/F13 on the topographical map and marked 4 on the orthophoto map.

3.4.1 Identify the street pattern at Groenheuwel.

3.4.2 Name ONE advantage and ONE disadvantage of the street pattern identified in QUESTION 3.4.1.

Advantage:

Disadvantage:

(2 x 2)

3.4.3 The area Groenheuwel (marked 4) on the orthophoto map is a low income residential area. Give TWO pieces of evidence from the orthophoto map to prove this statement.

(2 x 2)

3.5 Paarlberg in block F/G/H 8/9/10 is an example of a volcanic intrusive landform exposed above the Earth's surface after erosion. Refer to both the topographical map and orthophoto map when answering the questions that follow.

3.5.1 State the rock type that results from volcanism before it has been exposed above the Earth's surface.

(1 x 2)
3.5.2 Identify the landform referred to after it has been exposed above the Earth’s surface.

(1 x 2) (2)

3.5.3 Of what potential value is the Paarlberg feature likely to be to the economy of Paarl?

(1 x 2) (2)

3.6 Study the photograph of the Paarl Valley below, as well as on the topographical map (block F12).

3.6.1 What type of photograph is the photograph of the Paarl Valley?

(1 x 2) (2)

3.6.2 Identify the slope wind that people in the valley are likely to experience in the evenings in winter.

(1 x 2) (2)

3.6.3 Would you recommend any industrial development to take place in the Paarl Valley? Explain your answer

(2 x 2) (4)

3.7 Name ONE factor visible on the topographical map that indicates that nature conservation is important to the inhabitants of Paarl.

(1 x 2) (2)

QUESTION 4: GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

4.1 Data manipulation is used to control how features are represented on small and large-scale maps.

4.1.1 Explain the meaning of the term data manipulation.

(1 x 2) (2)

4.1.2 Explain why it is necessary to manipulate data on maps.

(1 x 2) (2)

4.2 Two learners from a school in Paarl have an assignment and have to take photographs of the Berg River. One has a 2.0 megapixel camera and the other has a 3.5 megapixel camera. The resolution of the photographs taken by the boys will differ.

4.2.1 Explain the meaning of the term resolution.

(1 x 2) (2)
4.2.2. Which one of the cameras will take better quality pictures? Explain your answer.

(2 x 2) (4)

4.3. Heavy rainfall sometimes results in flooding along the Berg River, as is evident in the image below. How could the local government use GIS to manage this disaster?

(2 x 2) (4)

4.4. Urbanisation has a negative impact on rivers. How will buffering prevent the mismanagement of the Berg River?

(2 x 2) (4)

4.5. Why are map projections important for the users of GIS?

(1 x 2) (2) (20)

TOTAL: 100
Appendix 1

Mind the Gap

Geography

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RESOURCE MATERIAL
1. An extract from topographical map 3311BD PAARL.
2. Orthophoto map 3311BD25 PAARL.

INSTRUCTIONS AND INFORMATION
1. Fill in your EXAMINATION NUMBER and your CENTRE NUMBER in the spaces provided on the cover page.
2. Answer ALL the questions in the spaces provided in this question paper.
3. You are supplied with a topographical map 3311BD PAARL and an orthophoto map of part of the mapped area.
4. You must hand in the topographical map and the orthophoto map to the invigilator at the end of this examination session.
5. You must use the blank page at the back of this question paper for all rough work and calculations. Do NOT detach this page from the question paper.
6. Show ALL calculations. Marks will be allocated for calculations and formulae.
7. You may use a non-programmable calculator.

This memorandum consists of 12 pages.
QUESTION 1: MULTIPLE-CHOICE QUESTIONS

The questions below are based on the 1:50 000 topographical map 3318DB PAARL, as well as the orthophoto map 3318DB 25 PAARL as part of the mapped area. Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) in the block next to each question.

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   C  3319CC  
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   A  Transversal  
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   D  Gauss conform  

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   A  Western Cape.  
   B  Northern Cape.  
   C  Eastern Cape.  
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   A  between 08:00–10:00.  
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   A  oxbow lake.  
   B  braided stream.  
   C  meander.  
   D  dendritic pattern.  

1.6 The man-made water feature at 33°38'24"S18°52'46"E/33°38'4"S18°52.8'E is a ...
   A  dam.  
   B  non-perennial river.  
   C  river.  
   D  windmill.  

ENGLISH  
Dipping tanks  
Firebreaks  
Landing strip  
Station  
Sports club  

AFRIKAANS  
Dipbakkie  
Voorbrande  
Landingstrook  
Stasie  
Sportclub.
1.7. The drainage pattern in blocks F8, G8 and H8 is ...
   A. trellis
   B. dendritic
   C. rectangular
   D. radial.

1.8. The land-use zone marked 1 on the orthophoto map is ...
   A. the zone of decay
   B. the rural-urban fringe
   C. a high income residential area
   D. an industrial zone.

1.9. The slope marked 2 on the orthophoto map is ...
   A. steep
   B. gentle
   C. concave
   D. convex.

1.10. The building marked 3 on the orthophoto map is a ...
   A. school
   B. factory
   C. silo
   D. smallholding.

**QUESTION 2: GEOGRAPHICAL TECHNIQUES AND CALCULATIONS**

2.1. Calculate the gradient between trigonometrical station 172 in block G8 and spot height -162 in block B9. Show ALL calculations. Marks will be allocated for calculations.

\[
\text{Gradient} = \frac{VI}{HE} \quad \text{Gradient} = \frac{VI}{HE}
\]

\[
VI = 173.6 - 162 = 11.6 \text{ m}
\]

\[
HE = 52 \text{ mm} \times 50000 = 2600 \text{ m}
\]

\[
1: \frac{224.13}{2600} \quad \text{(Range: 215.51 to 232.75)}
\]

2.2. The following is a cross section from the windmill (block E4) to trigonometrical station 184 (block E6).

[Cross section diagram]

2.2.1. Calculate the vertical exaggeration of the cross section above.
   \[\text{VE} = \frac{VS}{HS}\]
   \[\frac{1}{2} \times 200 = 100 \sqrt[3]{100000}\]
   \[\text{VE} = 1 \text{ cm to } 20 \text{ m}\]

2.2.2. Identify the features labelled X and Y on the cross section:
   X: other road / dirt (gravel) road / cultivated land
   Y: power line / cultivated land / farm boundary

2.2.3. Why are cross sections exaggerated?
   To see the difference in height
   (Concept)
2.3 Calculate the magnetic declination for the year 2011. Show ALL calculations. Marks will be allocated for calculations.

Difference in years = 2011 - 2002
= 9 years x 6° W
= 54° W

Magnetic declination in 2011 = 23°33' + 54°W
= 23°87'W
= 24°27'W

(5)

2.4 Give TWO reasons why the magnetic declination will be useful to a person using a map on a field trip.

It will allow the map to be set for accurate orientation ✓
It determines true north ✓
To calculate magnetic bearing ✓
Reaching a destination using a compass ✓
[Any TWO]

(2)

QUESTION 3: APPLICATION OF THEORY/MAP AND PHOTO INTERPRETATION

3.1 Refer to both the topographical map and the orthophoto map when answering the questions below.

3.1.1 Identify the shape of the town Paarl.

Linear ✓
Elongated ✓
[Any ONE]

(1 x 2)

3.1.2 Name TWO physical factors that determine the shape of the town Paarl.

The town developed along the river / Berg river ✓
The town developed along the mountain range / next to a steep slope ✓
Follows a valley ✓
[Any TWO]

(2 x 2)

3.2 What is the direction of Boland Agricultural College in block C7 from Paarl?

NW / WNW ✓

(1 x 2)

3.3 Compare Dal Josaft (block F12) and Noorder-Paarl (block F11) in terms of the following:

<table>
<thead>
<tr>
<th>DAL JOSAFAT</th>
<th>NOORDER-PAARL</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.1 Main land-use zone</td>
<td>Industrial / factories ✓</td>
</tr>
<tr>
<td>3.3.2 Land value</td>
<td>Low / cheap ✓</td>
</tr>
</tbody>
</table>
| 3.3.3 Degree of pollution | High / more ✓ | Low / less ✓ (3 x 2)

(6)

3.4 Refer to Groenheuwel in block E/F13 on the topographical map and marked 4 on the orthophoto map.

3.4.1 Identify the street pattern at Groenheuwel.

Planned irregular ✓

(1 x 2)

3.4.2 Name ONE advantage and ONE disadvantage of the street pattern identified in QUESTION 3.4.1.

Advantage: Free flow of traffic / less traffic jams ✓
More scenic / aesthetic / not boring ✓
Follows contours ✓
Saves petrol ✓
Saves time ✓
[Any ONE]

Disadvantage: Get lost easily ✓
Less people will be vulnerable to crime ✓
Difficult to develop infrastructure ✓
Difficult to expand / layout ✓
Many cul-de-sacs ✓
[Any ONE]

(2 x 2)

3.4.3 The area Groenheuwel (marked 4) on the orthophoto map is a low income residential area. Give TWO pieces of evidence from the orthophoto map to prove this statement.

Small stands ✓
Small houses ✓
Houses are of the same style / shape / design ✓
Close to the industries ✓
No vegetation / few trees ✓
High density / clustered ✓
Many foot paths leading to surrounding areas ✓
[Any TWO]

(2 x 2)
3.5 Paarlberg in block F/G/H 9/9/10 is an example of a volcanic intrusive landform exposed above the Earth's surface after erosion. Refer to both the topographical map and orthophoto map when answering the questions that follow.

3.5.1 State the rock type that results from volcanism before it has been exposed above the Earth's surface.

Igneous / Granite ✔ (1 x 2) (2)

3.5.2 Identify the landform referred to after it has been exposed above the Earth's surface.

Dome / bombardt / nawait ✔ (1 x 2) (2)

3.5.3 Of what potential value is the Paarlberg feature likely to be to the economy of Paarl?

Tourism / nature reserve ✔
Absailing ✔
Future mining ✔
Farming when it weatheres ✔
Provide building material ✔
Water supply ✔
Recreation ✔
Job creation ✔

[One of the above] (1 x 2) (2)

3.6 Study the photograph of the Paarl Valley below, as well as on the topographical map (block F12).

3.6.1 What type of photograph is the photograph of the Paarl Valley?

Horizontal / High oblique ✔ (1 x 2) (2)

3.6.2 Identify the slope wind that people in the valley are likely to experience in the evenings in winter.

Katabatic / downslope / gravitational wind ✔ (1 x 2) (2)

3.6.3 Would you recommend any industrial development to take place in the Paarl Valley? Explain your answer.

No ✔

Because pollution will be trapped by the inversion layer ✔
Air / water pollution ✔
People will experience respiratory problems ✔
Acid rain will destroy vegetation ✔

OR

Yes ✔
Flats ✔
Access to raw materials ✔
Availability of water ✔
Enough labour ✔

[Any ONE. Accept other justifiable reasons] (2 x 2) (4)

3.7 Name ONE factor visible on the topographical map that indicates that nature conservation is important to the inhabitants of the Paarl.

Paarlberg Nature Reserve ✔
Wild Flower Nature Reserve ✔
Protected areas / firebreaks ✔

[Any ONE] (1 x 2) (2)
QUESTION 4: GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

4.1 Data manipulation is used to control how features are represented on small and large-scale maps.

4.1.1 Explain the meaning of the term data manipulation.

The process used to organise data for your specific needs \(\checkmark\)

[Concept] (1 x 2) (2)

4.1.2 Explain why it is necessary to manipulate data on maps.

To make changes during data analysis \(\checkmark\)
To convert, re-arrange or analyse data to get answers \(\checkmark\)
To remove unnecessary information \(\checkmark\)
To add any additional information \(\checkmark\)
Where different projections are used you should be able to print maps with the same projection \(\checkmark\)
Where different scales are used you should be able to print maps on the same scale \(\checkmark\)

[ Any ONE of the above - Accept other reasonable answer] (1 x 2) (2)

4.2 Two learners from a school in Paarl have an assignment and have to take photographs of the Berg River. One has a 2, 0 megapixel camera and the other has a 3, 5 megapixel camera. The resolution of the photographs taken by the boys will differ.

4.2.1 Explain the meaning of the term resolution.

It refers to the degree of detail and clarity of an image \(\checkmark\)

[Concept] (1 x 2) (2)

4.2.2 Which one of the cameras will take better quality pictures? Explain your answer.

The one with 3, 5 megapixels \(\checkmark\)
Because it is a higher resolution camera \(\checkmark\)
Higher definition / better definition \(\checkmark\)
More squares per unit area \(\checkmark\)
Larger pixels which lead to clearer picture \(\checkmark\)

[ Any TWO of the above] (2 x 2) (4)

4.3 Heavy rainfall sometimes results in flooding along the Berg River, as is evident in the image below. How could the local government use GIS to manage this disaster?

The government could have used GIS in predicting floods \(\checkmark\)
Planning should have been done on how to control floods \(\checkmark\)
Communicate the occurrence of floods to the inhabitants \(\checkmark\)
GIS could enable the government to distribute information to the disaster management centres \(\checkmark\)
Use GIS to create a buffer zone around the river \(\checkmark\)

[Any TWO of the above - Accept other reasonable answer] (2 x 2) (4)

4.4 Urbanisation has a negative impact on rivers. How will buffering prevent the mismanagement of the Berg River?

Indicates where no agriculture and industries can be located \(\checkmark\)
Prevent pollution from pesticides and industrial wastes being deposited \(\checkmark\)
Leave areas clear for urban expansion \(\checkmark\)
Conserve natural areas / maintaining green belts \(\checkmark\)

[Any TWO of the above] (2 x 2) (4)

4.5 Why are map projections important for the users of GIS?

Has an influence on the level of distortion on a map / image \(\checkmark\)
Accurate calculation of areas \(\checkmark\)
Choosing the correct map / image for a particular purpose \(\checkmark\)
To know whether certain area are exaggerated or shrunk \(\checkmark\)

[Any One of the above] (1 x 2) (2)

TOTAL: 100
RESOURCE MATERIAL
An extract from topographical map 2230AA&AC MUSINA.
Orthophoto map 2230 AC 11 MUSINA SOUTH.

NOTE: The resource material must be collected by the schools for their own use.

INSTRUCTIONS AND INFORMATION
1. Write your centre number and examination number in the spaces on the
   ANSWER BOOK.
2. Answer ALL the questions in the spaces provided in this question paper.
3. You are supplied with a 1:50 000 topographical map 2230AA&AC MUSINA
   and an orthophoto map of a part of the mapped area.
4. The topographical map and the orthophoto map must be handed to the
   invigilator at the end of this examination session.
5. You may use the blank page at the back of this question paper for all rough
   work and calculations.
6. A non-programmable calculator may be used.
7. The following English terms and/or their Afrikaans translations are shown on
   the topographical map.

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<td>Begraafplaas</td>
</tr>
<tr>
<td>Copper mine</td>
<td>Kopermyn</td>
</tr>
<tr>
<td>Diggings</td>
<td>Uitgravings</td>
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<td>Vissplaas</td>
</tr>
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<td>Landing strip</td>
<td>Landingsloop</td>
</tr>
<tr>
<td>Refuse dump</td>
<td>Afvaldortingsstren</td>
</tr>
<tr>
<td>Rifle range</td>
<td>Skeletbaan</td>
</tr>
<tr>
<td>River</td>
<td>Rivier</td>
</tr>
<tr>
<td>Sewage disposal</td>
<td>Ricolafalwerkje</td>
</tr>
<tr>
<td>Shaft</td>
<td>Skag</td>
</tr>
<tr>
<td>Simes dam</td>
<td>Slikdam</td>
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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

The following questions are based on the 1:50 000 topographical map 2230AAAC MUSINA as well as the orthophoto map of a part of the mapped area.

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A – D) in the block next to each statement.

1.1 The contour interval of the topographical map is ...
   A 5 m.
   B 10 m.
   C 15 m.
   D 20 m.

1.2 The height of the N1 National Route at 2 in block F1 is ...
   A 500 m.
   B 520 m.
   C 540 m.
   D 560 m.

1.3 The settlement of Anton Villa (F6) originally developed as a ...
   A mining
   B farming
   C resort
   D junction

1.4 The feature numbered 3 in block H2 is ...
   A windpump
   B communication tower
   C grave
   D water tower

1.5 The word scale of the orthophoto map is:
   A 1 cm represents 10 000 m.
   B 1 cm represents 1 000 m.
   C 1 cm represents 100 m.
   D 1 cm represents 10 m.

1.6 The landform marked L-M on the orthophoto map is a ...
   A cuesta
   B valley
   C spur
   D mesa

1.7 The slope between L and M on the orthophoto map is ...
   A convex
   B concave
   C gentle
   D terraced

1.8 The direction of land-use J from land-use K on the orthophoto map is ...
   A west-northwest
   B north-northwest
   C northwest
   D southwest

1.9 The refuse dump at N on the orthophoto map is mainly for ...
   A industrial
   B domestic
   C agricultural
   D mining

1.10 The residential area marked G on the orthophoto map shows a rough ...
    A gridiron
    B radial
    C unplanned, irregular
    D planned, irregular

(10 x 2) [20]
QUESTION 2: GEOGRAPHICAL TECHNIQUES AND CALCULATIONS

2.1 Calculate the area of the rifle range (E) on the orthophoto map in km². Show ALL your calculations.

2.2 Determine the present magnetic bearing from trigonometrical station 17 (G1) to Spence Shaft (F5). Use the following steps as a guide:
- Date of map:
- Magnetic declination:
- Mean annual change:
- Difference in years:
- Total annual change:
- Magnetic declination in 2010:
- True bearing:
- Present magnetic bearing:

2.3 Give the co-ordinates (fix the position) of the reservoir in block G4.

2.4 Which one: the topographical map or the orthophoto map, has a larger scale?

QUESTION 3: APPLICATION OF THEORY/MAP AND PHOTO INTERPRETATION

3.1 Refer to the drainage pattern in blocks B/C10 on the topographical map.

3.1.1 Identify the drainage pattern assumed by the river system in these two blocks.

3.1.2 With reference to the topographical map, explain why the river system assumed this drainage pattern in blocks B/C10.

3.2 Refer to the houses found in blocks J/K6 on the topographical map.

3.2.1 Identify the settlement pattern of these buildings.

3.2.2 Give ONE reason for your answer to QUESTION 3.2.1.
3.2.3 With reference to the topographical map, state any TWO problems (disadvantages) that the inhabitants of these houses might experience.

- 
- 

(2 x 2) (4)

3.3 The N1 National Route passes through Musina on its way to the border post between South Africa and Zimbabwe.

3.3.1 State ONE advantage of the N1 passing through Musina, for motorists.

(1 x 2) (2)

3.3.2 State ONE disadvantage of the N1 passing through Musina, for motorists.

(1 x 2) (2)

3.4 What evidence on the topographical map and orthophoto map suggests that Musina is a central place town?

- 
- 

(2 x 2) (4)

3.5 Identify the man-made features labelled J and K on the orthophoto map.

J 
K 

(2 x 2) (4)

3.6 Give a possible reason for the location of man-made feature K.

(1 x 2) (2)

3.7 Identify any TWO primary economic activities practised in close proximity to Musina. You must also provide a block reference number for each of the activities mentioned.

- block 
- block 

(2 x 2) (4)
QUESTION 4: GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

4.1 Name any TWO components of a GIS.

4.2 Identify a polygon feature, a line feature and a point feature respectively in block G3.

4.3 The diagram below illustrates the concept of data integration. Study the diagram carefully and answer the following questions that follow:

(a) Explain what is meant by data integration.

4.4.1 Explain what is meant by data integration.
REsource MATERIAL
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(10 x 2) [20]
QUESTION 2: GEOGRAPHICAL TECHNIQUES AND CALCULATIONS

2.1 Calculate the area of the rifle range (E) on the orthophoto map in km². Show ALL your calculations.

Length = 10 x 0.1 m = 1 km

Breadth = 1.3 x 0.1 m = 0.13 km

Area = 1 km x 0.13 km = 0.13 km²

(Range: 0.12 km² - 0.14 km²)

2.2 Determine the present magnetic bearing from trigonometrical station 17 (G1) to Spans Shaft (F5). Use the following steps as a guide:

Date of map: 2002

Magnetic declination: 12°57'W

Mean annual change: 7W

Difference in years: 8 years

Total annual change: 56W

Magnetic declination in 2010: 13°53'W

True bearing: 78° - 80°

Present magnetic bearing: 91°53' - 93°53'

2.3 Give the co-ordinates (fix the position) of the reservoir in block G4.

22°19'15"S 30°03'50"E

OR

22°19'3"S 30°03'8"E

2.4 Which one, the topographical map or the orthophoto map, has a larger scale?

Orthophoto map

QUESTION 3: APPLICATION OF THEORY/MAP AND PHOTO INTERPRETATION

3.1 Refer to the drainage pattern in blocks B/C10 on the topographical map.

3.1.1 Identify the drainage pattern assumed by the river system in these two blocks.

Trellis ✔️

(1 x 2) (2)

3.1.2 With reference to the topographical map, explain why the river system assumed this drainage pattern in blocks B/C10.

Main stream flows on valley floor ✔️

Short tributaries flow down the valley flanks ✔️

Tributaries join main stream at 90° angles ✔️

(3 x 2) (6)

3.2 Refer to the houses found in blocks J/K6 on the topographical map.

3.2.1 Identify the settlement pattern of these buildings.

Isolated/dispersed ✔️

(1 x 2) (2)

3.2.2 Give ONE reason for your answer to QUESTION 3.2.1.

Buildings far apart from one another ✔️

(1 x 2) (2)

3.2.3 With reference to the topographical map, state any TWO problems (disadvantages) that the inhabitants of these houses might experience.

- Poor infrastructure ✔️
- Isolated - live far from large settlement ✔️
- Lack of services (no schools, clinics, shops) ✔️
- Boredom ✔️
- No exchange of ideas, skills and information ✔️

[Any TWO. Accept other] (2 x 2) (4)
3.3 The N1 National Route passes through Musina on its way to the border post between South Africa and Zimbabwe.

3.3.1 State ONE advantage of the N1 passing through Musina, for motorists.

- Stop over after long journey ✓✓
- Refueling of motor ✓✓
- Buy goods needed for travelling e.g. refreshments ✓✓
- [Any ONE. Accept other] (1 x 2) (2)

3.3.2 State ONE disadvantage of the N1 passing through Musina, for motorists.

- Slowing down of traffic/journey speed ✓✓
- Takes longer to reach final destination ✓✓
- Congestion ✓✓
- Increases risk of accidents ✓✓
- [Any ONE. Accept other] (1 x 2) (2)

3.4 What evidence on the topographical map and orthophoto map suggests that Musina is a central place town?

- Many urban services ✓✓
- Churches ✓✓
- Schools ✓✓
- Police Stations ✓✓
- Shops ✓✓
- Hospitals ✓✓
- Recreational facilities ✓✓
- People from surrounding rural area can use these urban services ✓✓
- Roads from different directions converge ✓✓
- [Any TWO] (2 x 2) (4)

3.7 Identify any TWO primary economic activities practised in close proximity to Musina. You must also provide a block reference number for each of the activities mentioned.

- Copper mining block H3 ✓✓
- Cultivation block G3 ✓✓
- Fish farming block I4 ✓✓
- Quarrying block G3 ✓✓
- Forestry block G1 ✓✓
- [Any TWO] (2 x 2) (4)

3.8 Give evidence from the topographical map that there are groundwater sources close to the earth's surface in the mapped area.

- Fountains ✓✓
- Windpumps ✓✓
- High drainage density/fine drainage density ✓✓
- [Any ONE] (1 x 2) (2)

3.9 Using evidence from the topographical map, explain the occurrence of housing clusters in block J2.

- Housing for factory workers ✓✓
- Close to factory/place of work ✓✓
- Save on transport cost to factory/place of work ✓✓
- [Any TWO] (2 x 2) (4)

QUESTION 4: GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

4.1 Name any TWO components of a GIS.

- Hardware ✓✓
- Software ✓✓
- Data ✓✓
- People ✓✓
- Procedures ✓✓
- Network ✓✓
- [Any TWO] (2 x 2) (4)
4.2 Identify a polygon feature, a line feature and a point feature respectively in block G3.

Polygon feature: cultivated land ☑
- woodland ☑
- sewage disposal works ☑
- cemetery ☑
- silos/ dam ☑
- mine dump ☑
- built-up area ☑

Line feature: non-perennial river ☑
- other road ☑
- national route ☑
- track/hiking trail ☑
- railway line ☑

Point feature: fountain ☑
- trees ☑
[Any ONE for each type of feature] (3 x 2) (6)

4.3 The diagram below illustrates the concept of data integration. Study the diagram carefully and answer the questions that follow:

4.3.1 Explain what is meant by data integration.

The integration of data from different maps into one map which summarises the overlaying process ☑
[Concept] (1 x 2) (2)

4.3.2 Name ONE problem that was experienced with data integration prior to the introduction of GIS.

- Maps have different scales ☑
- Different map projections are used on maps ☑
- Different georeferenced maps are used ☑
[Any ONE] (1 x 2) (2)

4.3.3 Of what importance is data integration to a geographer?

- A summary of integrated data is produced which makes it easier to analyse data ☑
[Concept] (1 x 2) (2)

4.4 What is a database?

- A storage system with linked tables ☑
- OR
- Data is stored in tables which are linked to other tables ☑
[Concept] (1 x 2) (2)

4.5 Why is it sometimes necessary to manipulate data in a database?

- Correct distortions ☑
- Sharpen definition ☑
- Ensure colour consistency ☑
- Correct latitude and longitude registration ☑
- Makes data more manageable ☑
[Any TWO] (1 x 2) (2)

TOTAL: 100
RESOURCE MATERIAL

1. An extract from topographical map 3424BB HUMANSDORP.
2. Orthophoto map 3424 BB 1 HUMANSDORP
3. NOTE: The resource material must be collected by the schools for their own use.

INSTRUCTIONS AND INFORMATION

1. Fill in your EXAMINATION NUMBER and your CENTRE NUMBER in the spaces provided on the cover page.
2. Answer ALL the questions in the spaces provided in this question paper.
3. You are supplied with a 1:50,000 topographical map 3424BB HUMANSDORP and an orthophoto map of a part of the mapped area.
4. You must hand in the topographical map and the orthophoto map to the invigilator at the end of this examination session.
5. You must use the blank page at the back of this paper for all rough work and calculations. Do NOT detach this page from the question paper.
6. Show ALL calculations. Marks will be allocated for calculations.
7. You may use a non-programmable calculator.
8. The following English terms and their Afrikaans translations are shown on the topographical map.

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<td>Riviermond</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Ghoribaen</td>
</tr>
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<td>Wetland</td>
<td>Vve</td>
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</table>
QUESTION 1

The questions below are based on the 1:50 000 topographical map 3424BB HUMANSDORP as well as the orthophoto map of a part of the mapped area. Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A – D) in the block next to each question.

1.1 The earth's curved surface is represented on the topographical map through the ... projection.

A Mercator
B Gauss Conform
C Lambert
D Transversal

1.2 The landform that is found at P in block B11, is a ....

A rocky outcrop.
B cape.
C sandy beach.
D coastal rock.

1.3 Aston Bay (E10) has a/an ... street pattern.

A gridiron
B radial/bobweb
C planned irregular/reef
D unplanned irregular

1.4 The slope south of Kwa Nondumo (C2) is ...

A gentle.
B steep.
C convex.
D concave.

1.5 An aerial photograph which shows contour lines, spot heights, trigonometrical stations and other labelled features, is called a/an ...

A oblique aerial photograph.
B topographical map.
C orthophoto map.
D vertical aerial photograph.

1.6 The mean magnetic declination of this map in 2010 was ...

A 26°50' east of true north.
B 26°50' west of true north.
C 24°08' west of true north.
D 24°08' east of true north.

QUESTION 2

1.7 The index of the map sheet northwest of Humansdorp is ...

A 3324DC
B 3324DD
C 3325CC
D 3424BA

1.8 The co-ordinates of trigonometrical station 140 in block B3 are ...

A 34°01'20"S 24°47'44"E / 34°01'30"S 24°47'7"E
B 34°02'40"S 24°48'16"E / 34°02'7"S 24°48'3"E
C 34°01'20"E 24°47'44"S / 34°01'30"E 24°47'7"S
D 34°02'40"E 24°48'16"S / 34°02'7"E 24°48'3"S

1.9 The feature numbered 1 on the orthophoto map is a ...

A soccer field.
B sewage works.
C dam.
D marsh.

1.10 The scale of the orthophoto map is ... than that of the topographical map.

A 5 times smaller
B 5 times larger
C 40 times larger
D 40 times smaller

2.1 Determine the magnetic bearing of trigonometrical station 94 in block E1 from spot height 97 in block D1 for 2010. Show ALL calculations. Marks will be allocated for calculations.
2.2 Calculate the average gradient of Main Street on the orthophoto map from point 7 to 8. Show ALL calculations. Marks are allocated for calculations.

2.3 Identify the man-made feature marked 2 on the orthophoto map.

2.4 Draw a free-hand (roughly) cross-section of the landform from spot height 24 (F7) to trigonometrical station number 230 (F5) on the topographical map.

2.5 Identify the landform represented in the cross-section that you drew in QUESTION 2.4.

2.6 What is the height of the dam wall marked W in blocks F1 and F2 on the topographical map?

2.7 Block E1 on the topographical map is covered by cultivated land. Calculate the area of this block in km². Show ALL calculations. Marks are allocated for calculations.

QUESTION 3

3.1 Refer to both the topographical map and the orthophoto map in answering the questions below.

3.1.1 The mapped area may be described as a wet region. Give TWO pieces of evidence to support this statement.

3.1.2 The ocean has a cooling effect along the coast. What type of breeze will be experienced during the late afternoon at Ou Dorp Caravan Park in block C11 on the topographical map?
3.1.3 Find the cemetery numbered 9 on the orthophoto map. In which urban land use zone is the cemetery located?

(1 x 2) (2)

3.1.4 Give ONE reason, visible on the orthophoto map, why the specific location was selected for the cemetery.

(1 x 2) (2)

3.1.5 Give a reason for the cultivation of rows of trees on the fruit farms in blocks D9 and D10.

(1 x 2) (2)

3.1.6 The streams in block E3 are flowing fairly slowly. Quote evidence from the map to support this statement.

(1 x 2) (2)

3.1.7 Krombaski (I6) is often visited by local tourists. Name TWO recreational activities that these tourists engage in during their stay at this resort.

(2 x 2) (4)

3.1.8 Paradise Beach (G8) is a new urban development. With reference to its location, name TWO strategies that can be implemented to ensure sustainable development of the coastline.

(2 x 2) (4)

3.1.9 The cultivated land in block F3 on the topographical map is irrigated largely by the furrow method. Name TWO advantages of this method.

(2 x 2) (4)

3.1.10 The area marked X in blocks F4 and F5 on the topographical map is relatively flat/gentle, but not inhabited by human beings. Give ONE reason why this is the case.

(1 x 2) (2)

3.1.11 Identify the landfill numbered 3 – 4 on the orthophoto map.

(1 x 2) (2)

3.1.12 Compare the settlements Wavecrest (block B11) and Humansdorp (block B2) on the topographical map in terms of the following, on the table provided:

<table>
<thead>
<tr>
<th>STREET PATTERN</th>
<th>WAVECREST</th>
<th>HUMANSDORP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow of traffic</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(4 x 2) (8)

3.1.13 What street name is given to the R102 where it runs through Humansdorp (B2)?

(1 x 2) (2)
<table>
<thead>
<tr>
<th>QUESTION</th>
<th>DETAILS</th>
<th>MARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Identify a polygon feature and a line feature in block C2.</td>
<td>(2 x 2)</td>
</tr>
<tr>
<td>4.2</td>
<td>With reference to the concept of attribute data, answer the following questions:</td>
<td>(2 x 2)</td>
</tr>
<tr>
<td>4.2.1</td>
<td>Define the term attribute data.</td>
<td>(1 x 2)</td>
</tr>
<tr>
<td>4.2.2</td>
<td>Name ONE attribute of the N2 in block A2.</td>
<td>(1 x 2)</td>
</tr>
<tr>
<td>4.3</td>
<td>Data integration is combining different types of data for the purpose of decision making. Describe TWO types of data that a farmer in block A2 will need to use in deciding whether to irrigate or not.</td>
<td>(2 x 2)</td>
</tr>
<tr>
<td>4.4</td>
<td>GIS allows us to use thematic layers on maps. Refer to the topographical map and name TWO layers of information that were used in compiling the map.</td>
<td>(2 x 2)</td>
</tr>
</tbody>
</table>

TOTAL: 100
RESOURCE MATERIAL
1. An extract from topographical map 3424BB HUMANSDORP.
2. Orthophoto map 3424 BB 1 HUMANSDORP
3. NOTE: The resource material must be collected by the schools for their own use.

INSTRUCTIONS AND INFORMATION
1. Fill in your EXAMINATION NUMBER and your CENTRE NUMBER in the spaces provided on the cover page.
2. Answer ALL the questions in the spaces provided in this question paper.
3. You are supplied with a 1:50 000 topographical map 3424BB HUMANSDORP and an orthophoto map of a part of the mapped area.
4. You must hand in the topographical map and the orthophoto map to the invigilator at the end of this examination session.
5. You must use the blank page at the back of this paper for all rough work and calculations. Do NOT detach this page from the question paper.
6. Show ALL calculations. Marks will be allocated for calculations.
7. You may use a non-programmable calculator.
8. The following English terms and their Afrikaans translations are shown on the topographical map.

<table>
<thead>
<tr>
<th>ENGLISH</th>
<th>AFRIKAANS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diggings</td>
<td>Uitgrawings</td>
</tr>
<tr>
<td>Caravan Park</td>
<td>Karavaanpark</td>
</tr>
<tr>
<td>Sewage Works</td>
<td>Riolierkie</td>
</tr>
<tr>
<td>River Mouth</td>
<td>Riviermond</td>
</tr>
<tr>
<td>Golf Course</td>
<td>Gholfsban</td>
</tr>
<tr>
<td>Wetland</td>
<td>Vlei</td>
</tr>
</tbody>
</table>

MARKS: 100

This memorandum consists of 10 pages.
QUESTION 1

The questions below are based on the 1:50 000 topographical map 3424BB HUMANSDORP, as well as the orthophoto map of a part of the mapped area. Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A – D) in the block next to each question.

1.1 The earth's curved surface is represented on the topographical map through the ... projection.
A. Mercator
B. Gauss Conform
C. Lambert
D. Transversal

1.2 The landform that is found at P in block B11, is a ...
A. rocky outcrop
B. cape
C. sandy beach
D. coastal rock

1.3 Ashton Bay (E10) has a/an ... street pattern
A. grid iron
B. radial/circular
C. planned irregular/free
D. unplanned irregular

1.4 The slope south of Kwa Nomzamo (C2) is ...
A. gentle
B. steep
C. convex
D. concave

1.5 An aerial photograph which shows contour lines, spot heights, trigonometrical stations and other labelled features, is called a/an ...
A. oblique aerial photograph
B. topographical map
C. orthophoto map
D. vertical aerial photograph

1.6 The mean magnetic declination of this map in 2010 was ...
A. 26°50' east of true north
B. 26°50' west of true north
C. 24°08' west of true north
D. 24°08' east of true north

QUESTION 2

1.7 The index of the map sheet northwest of Humansdorp is ...
A. 3324DC
B. 3324DD
C. 3325CC
D. 3424BA

1.8 The co-ordinates of trigonometrical station 140 in block B3 are ...
A. 34°01'20"S24°47'44"E / 34°01'3"S24°47'7"E
B. 34°02'40"S24°46'16"E / 34°02'7"S24°46'3"E
C. 34°01'20"S24°47'44"S / 34°01'3"E24°47'7"S
D. 34°02'40"E24°48'16"S / 34°02'7"E24°48'3"S

1.9 The feature numbered 1 on the orthophoto map is ...
A. a soccer field
B. a sewage works
C. a dam
D. a marsh

1.10 The scale of the orthophoto map is ... than that of the topographical map.
A. 5 times smaller
B. 5 times larger
C. 40 times smaller
D. 40 times larger

(10 x 2) [20]
2.2 Calculate the average gradient of Main Street or the orthophoto map from point 7 to 8. Show ALL calculations. Marks are allocated for calculations.

\[ \text{VI} = 145 \text{ m} - 120 \text{ m} \]
\[ = 25 \text{ m} \ obt \]

\[ \text{HD} / \text{HE} = (7.6 \text{ cm} - 8.2 \text{ cm}) \times 100 \]
\[ = 700 \text{ m} \ to \ 820 \text{ m} \ obt \]

\[ \text{Gradient} = \frac{\text{VI} \text{ OR HD}}{\text{HE}} \]
\[ = \frac{25}{700 \ to \ 820} \]
\[ = 1.30 \text{ to } 0.28 \]

2.3 Identify the man-made feature marked 2 on the orthophoto map.

Cultivated land \( \checkmark \)

2.4 Draw a free-hand (rough) cross-section of the landform from spot height 24 (F7) to trigonometrical station number 296 (F8) on the topographical map.

2.5 Identify the landform represented in the cross-section that you drew in QUESTION 2.4.

Valley/Floodplain \( \checkmark \)

2.6 What is the height of the dam wall marked W in blocks F1 and F2 on the topographical map?

60 m \( \checkmark \) (Give ONE mark) \( \checkmark \)

2.7 Block E1 on the topographical map is covered by cultivated land. Calculate the area of this block in km\(^2\). Show ALL calculations. Marks are allocated for calculations.

Area = Length x Breadth \( \checkmark \)
\[ = (3.6 \text{ cm} \ to \ 3.2 \text{ cm}) \times (3.6 \text{ cm} \ to \ 3.6 \text{ cm}) \]
\[ = 1.0 \text{ km} \times 1.0 \text{ km} \]
\[ = 1.0 \text{ km}^2 \ to \ 1.0 \text{ km}^2 \]

QUESTION 3

3.1 Refer to both the topographical map and the orthophoto map in answering the questions below.

3.1.1 The mapped area may be described as a wet region. Give TWO pieces of evidence to support this statement.

Many rivers \( \checkmark \)
Intensive cultivation \( \checkmark \)
Many dams \( \checkmark \)
 Dense vegetation/woodland/coastal forests \( \checkmark \)
Marshes/Wetlands \( \checkmark \)
East coast \( \checkmark \)
[Any TWO] \( \checkmark \)

3.1.2 The ocean has a cooling effect along the coast. What type of breeze will be experienced during the late afternoon at Ou Domp Caravan Park in block E11 on the topographical map?

Sea breeze/Onshore breeze \( \checkmark \)

3.1.3 Find the cemetery numbered 9 on the orthophoto map. In which urban land use zone is the cemetery located?

Rural-urban fringe \( \checkmark \)

(2)
3.1.4 Give ONE reason, visible on the orthophoto map, why the specific location was selected for the cemetery.

- Away from residences ✓
- More peaceful ✓
- Large piece of land available ✓
- Land cheaper on outskirts of the city ✓
- Land is flat ✓
- Outside city ✓
- Room for expansion ✓
- Accessibility ✓

[Any ONE] (1 x 2) (2)

3.1.5 Give a reason for the cultivation of rows of trees on the fruit farms in blocks D9 and D10.

- Act as wind breaker ✓
- Prevent soil erosion ✓
- Aesthetic reasons/beautification ✓

[Any ONE] (1 x 2) (2)

3.1.6 The streams in block E3 are flowing fairly slowly. Quote evidence from the map to support this statement.

- Gentle slopes / contour lines are far apart ✓
- Marsh/Dam ✓

[Any ONE] (1 x 2) (2)

3.1.7 Krombasa (K) is often visited by local tourists. Name TWO recreational activities that these tourists engage in during their stay at this resort.

- Boating ✓
- Surfing ✓
- Swimming ✓
- Fishing or angling ✓
- Sunbathing ✓
- Beach volleyball ✓
- Beach soccer ✓
- Hiking ✓
- Camping ✓
- Scuba diving ✓

[Any TWO. Accept other reasonable answer] (2 x 2) (4)

3.1.8 Paradise Beach (G9) is a new urban development. With reference to its location, name TWO strategies that can be implemented to ensure sustainable development of the coastline.

- Protect the beach by using indigenous knowledge in building ✓
- Avoid overdevelopment along the beach ✓
- Protect marine life ✓
- Protect trees along the beach/Avoid deforestation ✓
- Protect beach dunes ✓
- Use local labour ✓
- Develop houses that will fit into the surroundings ✓
- Maintain nature reserves ✓
- Well-engineered infrastructure ✓
- Development must follow contour lines ✓
- Public awareness programmes ✓
- Conservation management ✓
- Legislation ✓

[Any TWO. Accept other reasonable answer] (2 x 2) (4)

3.1.9 The cultivated land in block F3 on the topographical map is irrigated largely by the furrow method. Name TWO advantages of this method.

- Inexpensive or cheap ✓
- Does not need much attention ✓
- Does not need machinery ✓
- No technical knowledge needed ✓
- Flow of water easily controlled ✓
- Reduced evaporation ✓

[Any TWO] (2 x 2) (4)

3.1.10 The area marked X in blocks F4 and F5 on the topographical map is relatively flat/gentle, but not inhabited by human beings. Give ONE reason why this is the case.

- It has swamps and marshes ✓
- Wetland ✓
- Protected area ✓
- Unstable soil ✓
- Mosquitoes/insects ✓

[Any ONE] (1 x 2) (2)

3.1.11 Identify the landform numbered 3-4 on the orthophoto map.

- Valley ✓

(1 x 2) (2)
3.1.12 Compare the settlement Wavecrest (block B11) and Humansdorp (block B2) on the topographical map in terms of the following, on the table provided:

<table>
<thead>
<tr>
<th>WAVECREST</th>
<th>HUMANDSORP</th>
</tr>
</thead>
</table>
| Street pattern     | Irregular/free      | Grid/rectangular
| Pattern/paved      | Irregular          |                 |
| Flow of traffic    | Traffic flows faster | Traffic flows slower/congestion |

(4 x 2) 

3.1.13 What street name is given to the R102 where it runs through Humansdorp (B2)?

Voorstreek (2) 

QUESTION 4

4.1 Identify a polygon feature and a line feature in block C2.

Polygon feature: dam / street block / recreational zone / cultivated land / built up area / excavation / school

Line feature: road / street / contour line / river / farm boundary / row of trees / hiking trail

(2 x 2) (4)

4.2 With reference to the concept of attribute data, answer the following questions.

4.2.1 Define the term attribute data.

This is descriptive data (CONCEPT) (1 x 2) (2)

4.2.2 Name ONE attribute of the N12 in block A2.

It is a national road
It is a freeway
Has many lanes
Terraced road
Has off- and on-ramps
Road is level
Road is straight
[Any ONE] 

(1 x 2) (2)

4.3 Data integration is combining different types of data for the purpose of decision-making. Discuss TWO types of data that a farmer in block A5 will consider before cultivation.

Availability of water
Fertility of soil
Relief of the land (slope)
Microclimate
Access to infrastructure
Access to transport
[Any TWO, Accept other logical answers] (2 x 2) (4)

4.4 GIS allows us to use thematic layers on maps. Refer to the topographical map and name TWO layers of information that were used in compiling the topographical map of Humansdorp.

Infrastructure – rail links, power lines
Land use – industries, churches, hospitals, etc
Relief features – steepness of the land
Vegetation – natural, cultivated
Drainage – rivers, marshes
[Any TWO] (2 x 2) (4)

4.5 The Hip Hop Joint company wants to open a new store in Jeffreys Bay. Suggest TWO ways in which GIS can be used to assist with the location of the store.

To determine the proximity of similar stores in the area
Gives an idea of earning potential in the area
Indicates population density of area
Indicates accessibility
Can determine compatibility with other stores
Determine crime levels
Determine availability of open land
[Any TWO, Accept any other reasonable answer] (2 x 2) (4)

TOTAL: 100
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