basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

Geography Self Study Guide

Notes

and

Exam Practise

Questions

About this Study Guide: 3

PART ONE 4

How to approach Paper 1 examination? 4

Managing your time: 4

The structure of the paper: 4

Exam instruction verbs: 4

PART TWO 6

High Pressure cell 6

Low Pressure cell 9

Mid-latitude cyclones 10

Tropical cyclones 10

Berg winds 24

Aspect 25

Temperature Inversion 26

Valley winds / Anabatic winds/ Upslope- 27

Mountain winds/ Katabatic winds/ Downslope winds - 28

Heat Island 28

Drainage Basin 37

Drainage Patterns 37

Drainage density 39

Hydrograph 40

Stream Profile 41

Meanders 41

River capture 42

PART THREE (Mapwork) 53

Examination Guidelines for Mapwork (Paper 2) 53

GEOGRAPHIC SKILLS AND TECHNIQUES 53

CLIMATE AND WEATHER 56

FLUVIAL PROCESSES (GEOMORPHOLOGY) 57

ECOLOGY 58

PEOPLE AND THEIR NEEDS (ECONOMIC GEOGRAPHY) 59

PEOPLE AND PLACES: SETTLEMENT GEOGRAPHY 61

C A L C U L A T I O N S 64

DISTANCE 64

AREA 65

GRADIENT 66

MAGNETIC DECLINATION 67

About this Study Guide:

This Self Study Guide is designed to explain concepts that seem to be problematic for learners in the Grade 12 exams. The first part, **Part One**, focuses on the **structure** of **Paper 1**, followed by explanation of the most common **action verbs** used in the question paper and how learners should manage their time. **Part Two** focuses on the selected **key concepts** with their **explanatory notes**, followed by typical **examples of examination questions** from previous question papers. Learners are also guided on how to use a mark allocation (on a question) in order to determine the extent of your response. The last section, **Part Three**, focuses on mapwork. The material in this section is adapted from Telematics project that stems from the cooperation between the Western Cape Education Department and Stellenbosch University.

Compiled by:

Pule Rakgoathe
CES: Geography
Department of Basic Education
222 Struben Street
Pretoria
0001
Tel: 012 857 4185
Fax: 012 328 2128
Email: rakgoathe.p@dbe.gov.za

PART ONE

How to approach Paper 1 examination?

Managing your time:

Paper 1 is written for Three hours. Ensure that you spend 1 hour on each of the three questions.

The structure of the paper:

- The paper is divided into two sections, namely Section A and B.
- Each of these two sections consists of two questions.
- Answer three questions out of these four.
- Each of the four questions will start with two sets of short/ objective questions worth 10 marks each.

Each of the four questions will also include two paragraph type questions of 12 marks each. These questions should not be answered in point form as they require analytical thinking and insight.

Exam instruction verbs:

Ensure that you understand very clearly the meaning of **instruction verbs** in each question, for example:

1. **Account**: To explain by relating circumstances or giving reasons.

e.g. There is less rain in the interior of SA in winter because the air coming from the Kalahari High Pressure cell is cold and descending. This leads to sunny days with clear skies and cold nights and the formation of frost or fog.

2. **Compare and contrast**: To examine things to see how they are alike and

how they differ.

e.g. Both commercial and subsistence farming deal with the planting of crops but the commercial farming is labour intensive, extensive and for profit making while subsistence farming is for family consumption.

3. **Define**: A precise clear meaning of a term or concept using words.

e.g. Isobars are lines joining places with the same pressure on a map.

4. **Describe**: Write about the main features of something. This should be done

by expanding on a statement.

e.g. Squatter settlement is a residential area that is often associated with poor living conditions and houses are mostly shacks and lack basic services such a water and sanitation.

5. **Distinguish**: Identify the characteristics that make two or more ideas, concepts or issues different

e.g. Air in a High is descending and circulating outwards in an anticlockwise direction while air in a Low is rising and spiraling inwards in a clockwise direction (in the southern hemisphere)

6. **Discuss**: Write about a feature, giving all information

7. **Explain**: Give a full reason, results or causes of a particular feature.

e.g. Tropical cyclones dissipate over the land because of the friction caused by objects on the land surface.

8. **Identify**: To single out from other information

e.g. The landform marked H is a mesa.

9. **List**: write a short or brief statement, term or word.

e.g. Crime and traffic congestion are some of the urban problems

10. **Justify**: Give a supportive statement for the answer you provided.

e.g. Eline is the fifth tropical cyclone to attack the area because tropical cyclones are named alphabetically in the order of occurrence during a specific season.

11. **Suggest**: Analyse a problem in a given situation and give possible reasons or ideas that can be plausible solutions.

e.g. Factories can reduce air pollution by building high chimney stacks that release smoke into the higher layers of the atmosphere

12. **Name**: Similar to mention

e.g. South Atlantic High Pressure cell is found on the eastern side of SA.

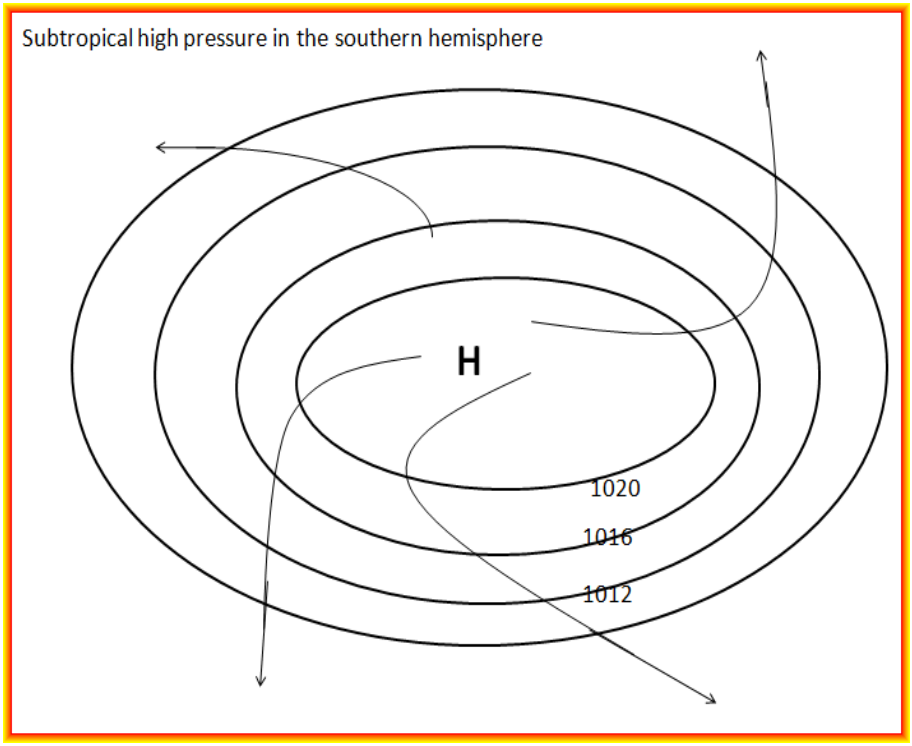
PART TWO

Concept:

High Pressure cell

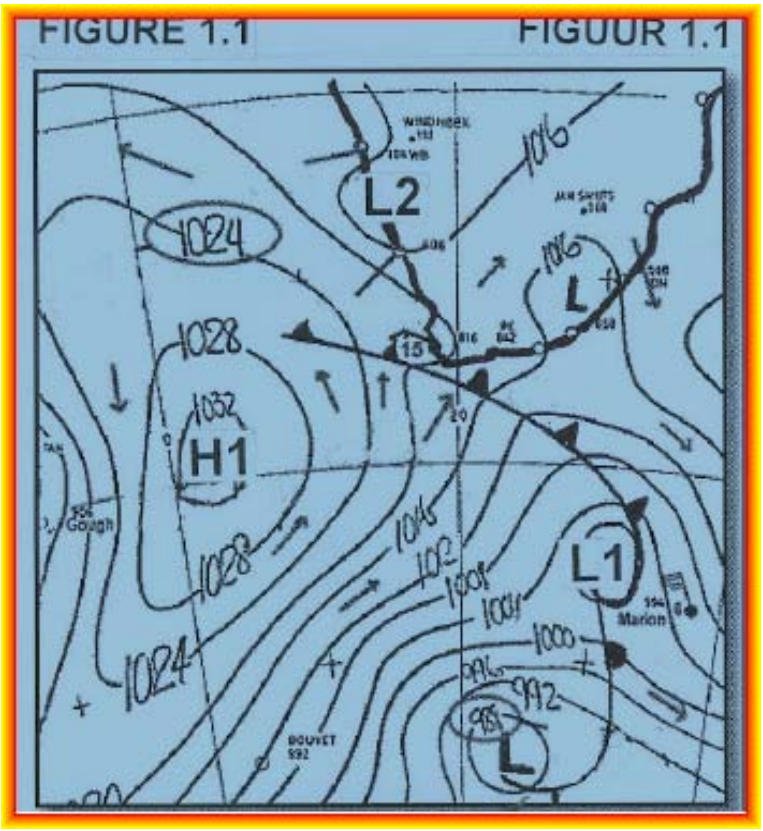
An area with the central pressure that is relatively higher than the surrounding pressure. Air circulation around this system is anticyclonic and thus high pressure cells are also referred to as **anticyclones**. They appear with near-concentric isobars on synoptic maps and indicated with letter **H**. They are generally associated with fair weather (clear and relatively calm conditions causing night time cooling and the formation of dew, frost or fog). In South Africa, our weather is affected by three high pressure cells namely; **South Atlantic HP, South Indian HP and Kalahari HP**.

Air **subsides/ sinks** within Highs, and on reaching the ground **diverges/ spirals outward**. In the southern hemispheres air circulates in an **anticlockwise** direction while it circulates in a **clockwise** direction in the northern hemisphere.



Exam question based on the concept explained above:

Study **Figure 1.1** showing a simplified synoptic weather map of South Africa. Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A – D) next to the questions number (1.1.1 – 1.1.5) in the answer book, for example 1.6 A.



1..1 High-pressure cell H1 is the … high –pressure cell.

A South Pacific
B South Atlantic
C South Indian
D Kalahari

1.1.2 The following air movements are associated with high-pressure cell H1:

A Subsidence, convergence, clockwise rotation
B Uplift, divergence, anticlockwise rotation
C Uplift, convergence, clockwise rotation
D Subsidence, divergence, anticlockwise rotation

1.1.3 Low-pressure cell L1 is in the … stage of development.

A Polar front/initial
B Wave

C Warm sector
D Occlusion

1.1.4 The lines on the synoptic weather map linking places of equal pressure are known as ...

A Isobars
B Isotherms
C Isohyets
D Isotopes

1.1.5 Low-pressure cell L2 is a/an ... low pressure

A Coastal
B Tropical
C Extra-tropical
D Equatorial

(5 x 2) (10)

Answer to the exam question:

1.1.1 B ✓✓
1.1.2 D ✓✓
1.1.3 C ✓✓
1.1.4 A ✓✓
1.1.5 A ✓✓

An additional example to practise:

1.1 Which of the following best describes the surface wind circulation around the centre of a High pressure system in the Southern Hemisphere?
a) counter-clockwise and spiralling outward
b) counter-clockwise and spiralling inward
c) clockwise and spiralling outward
d) clockwise and spiralling inward

1.2 In a High, air displays descending motion. The sinking air experiences (<u>increasing</u>, <u>decreasing</u>) atmospheric pressure. Consequently, the descending air (<u>expands</u>, is <u>compressed</u>) and its temperature (<u>increases</u>, <u>decreases</u>). 1x3

1.3 Descending air in a High leads to (fair, stormy) weather.1x2

Answer to practice example:

1.1 a ✓✓ 1x2

1.2 In a High, air displays descending motion. The sinking air experiences (<u>increasing</u>✓) atmospheric pressure. Consequently, the descending air (is <u>compressed</u>✓) and its temperature (<u>increases</u>✓). 1x3

1.3 Descending air in a High leads to (fair✓✓) weather.

Concept:

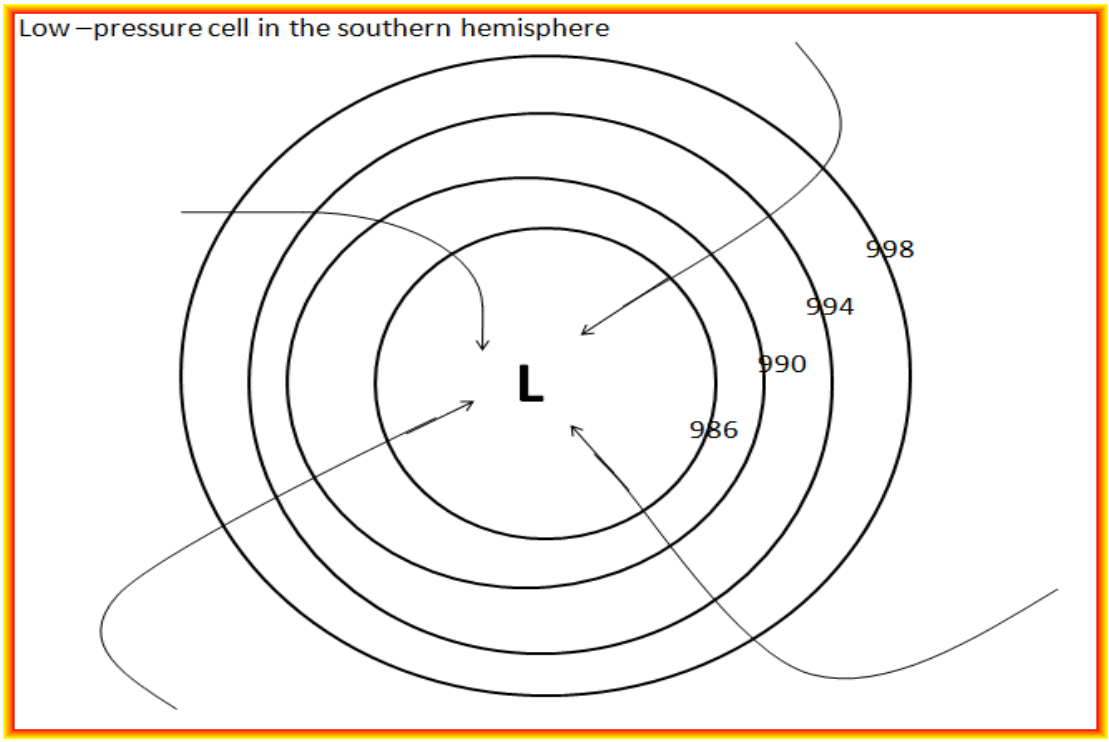
Low Pressure cell

An area with the central pressure that is relatively lower than the surrounding pressure. Air circulation around this system has a sense of rotation that is the same as that of the earth's rotation, so it is called cyclonic. Because this circulation and relative low pressure co-exist, Lows are also referred to as **cyclones**. On synoptic maps they are indicated with letter **L**.

They are generally characterised by a variety of weather including cloudy or overcast skies and stormy conditions, warm and cold sectors, air-mass boundaries
called fronts (labelled warm, cold, or stationary depending on their movement), and rapidly changing conditions over short distances across fronts.

Air **ascends/ rises** within Lows, and **spirals inwards** towards the centre. In the southern hemisphere air circulates in a **clockwise** direction while it circulates in an **anticlockwise** direction in the northern hemisphere.

In South Africa, our weather is affected by low pressure cells such as ***mid-latitude cyclone, cut-off low, coastal low and very rarely tropical cyclone***.



EXAMPLES OF LOW PRESSURE SYSTEMS:

Mid-latitude cyclones

- These are low pressure weather systems that occur in the middle latitudes between **30° and 60° latitude** north and south of the equator.
- They are sometime called temperate cyclones, extratropical cyclones, mid-latitude cyclones, frontal depressions or wave cyclones.
- The system is made up of a **cold front** and a **warm front**.
- The **cold fronts** reach South Africa **mostly in winter** when all the pressure belts and wind systems move slightly north.
- This is why the **south-western Cape** receives **winter rainfall**.
- The rain is brought by cold fronts passing over this area passing from **east to west**.
- The warm front is bent southwards away from South Africa.

Tropical cyclones

- A tropical cyclone is an intense low-pressure cell that occurs over warm tropical oceans.
- They are called **tropical cyclones** in the south Indian Ocean; **hurricanes** in the north Pacific regions; **typhoons** in the western North Pacific; and **Willy-Willies** in Australia.
- The sea surface temperature should be above 27℃.
- It is characterised by a calm and warm centre called an eye. Air in the eye is sinking hence there is no rain.
- Air around the eye is warm and moist. It will rise causing instability and strong winds leading to condensation and heavy rain.
- Tropical cyclones are named alphabetically, e.g. Aida, Bertha, Coleen, etc.
- They are known for their damaging effect, for example

  -Storm tides, waves, and currents at the coast will severely damage ships, marinas, and pleasure boats.

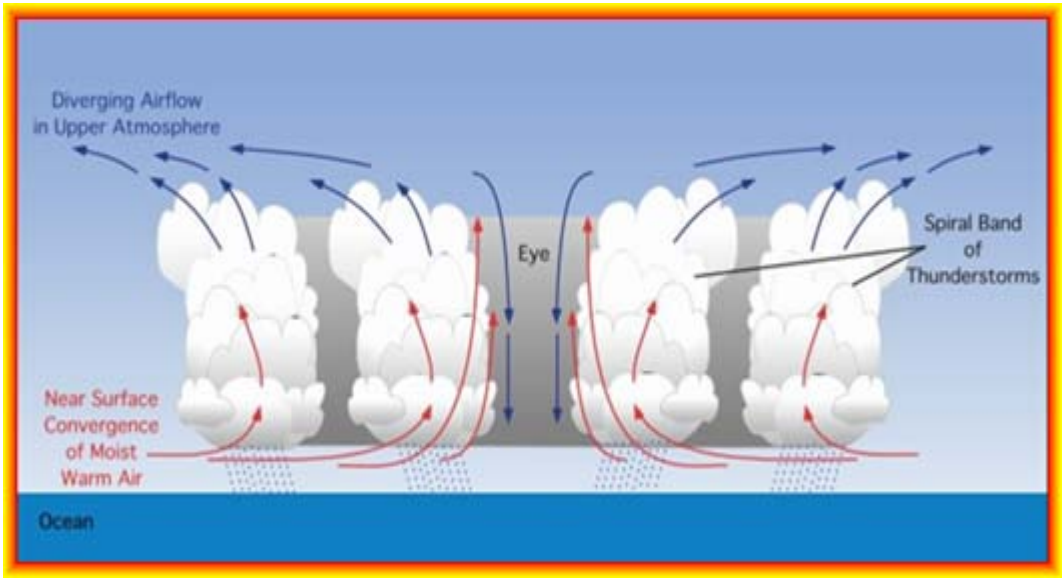
  -Winds with high speeds associated with bands of thunderstorms damage and destroy structures in two ways. First, many homes are damaged or destroyed when the high wind simply lifts the roof off of the dwellings. With the roof gone, the walls are much easier to be blown down by the hurricane's wind. The second way the wind destroys buildings is when the wind picks up the debris such as wood, metal, trash cans, tree branches, etc. and sends them

hurling at high speeds into other structures. Much of the damage in windstorms is caused by flying debris.

-In addition to the storm surge and high winds, tropical cyclones bring torrential rains and flooding in area. Even after the wind has diminished, flooding of these storms remains for several days.

Floods may destroy agricultural land and cattle, infrastructure and cause most deaths as a result of drowning.

A vertical cross section of the hurricane circulation



- at low-levels warm, moist air converges and rises
- at the upper level (tropopause) air diverges
- rising air is characterised by instability, cloud formation and heavy rain (thunderstorms adjacent to the eye).
- subsidence on outer edge of storm
- rain bands
- sinking air in the eye, cloudless and no rain, calm conditions

Exam questions based on the concept explained above:

Study **Figure 1.3A** which represents a section of the world map showing the location and movement of tropical cyclones/ hurricanes in the South Indian Ocean and the

West Indies respectively. Also refer to the article and satellite image of Hurricane Ike in Figure 1.3B.

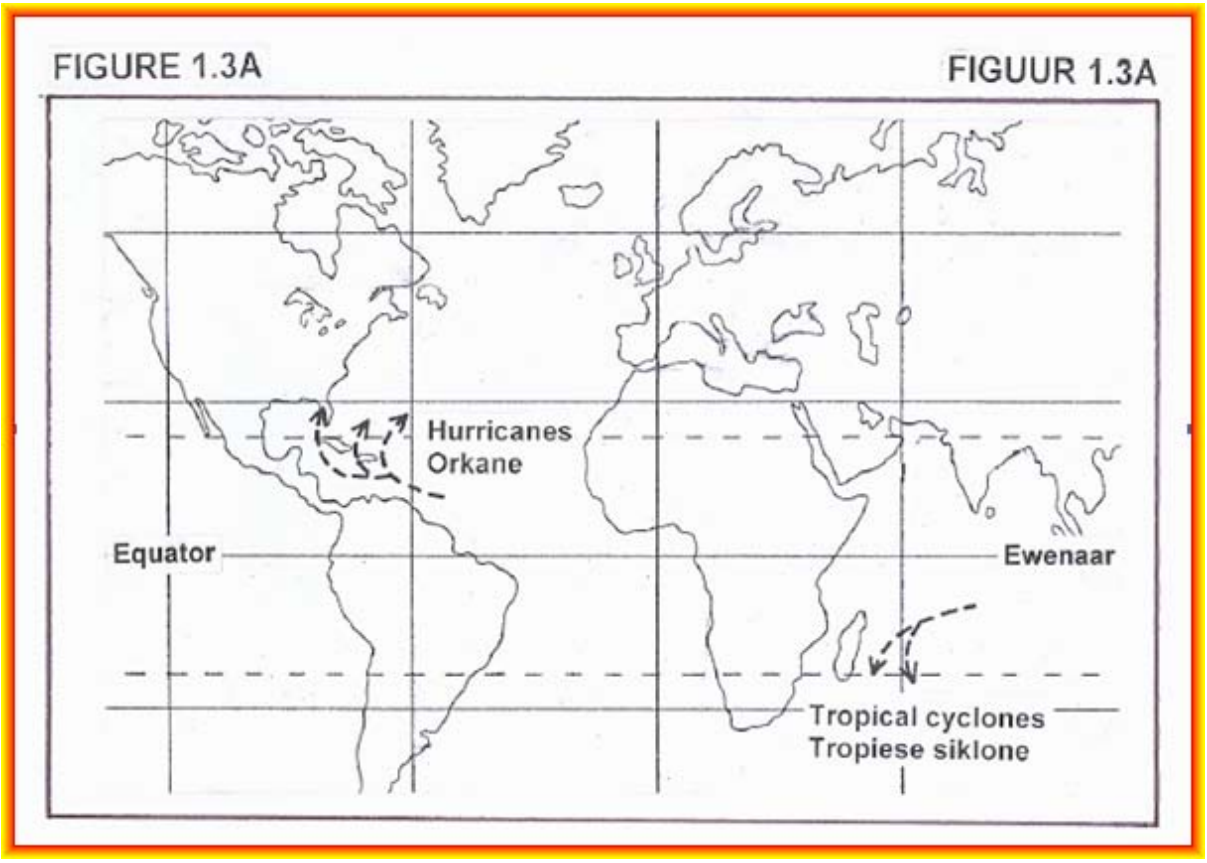


FIGURE 1.3B

HURRICANE IKE

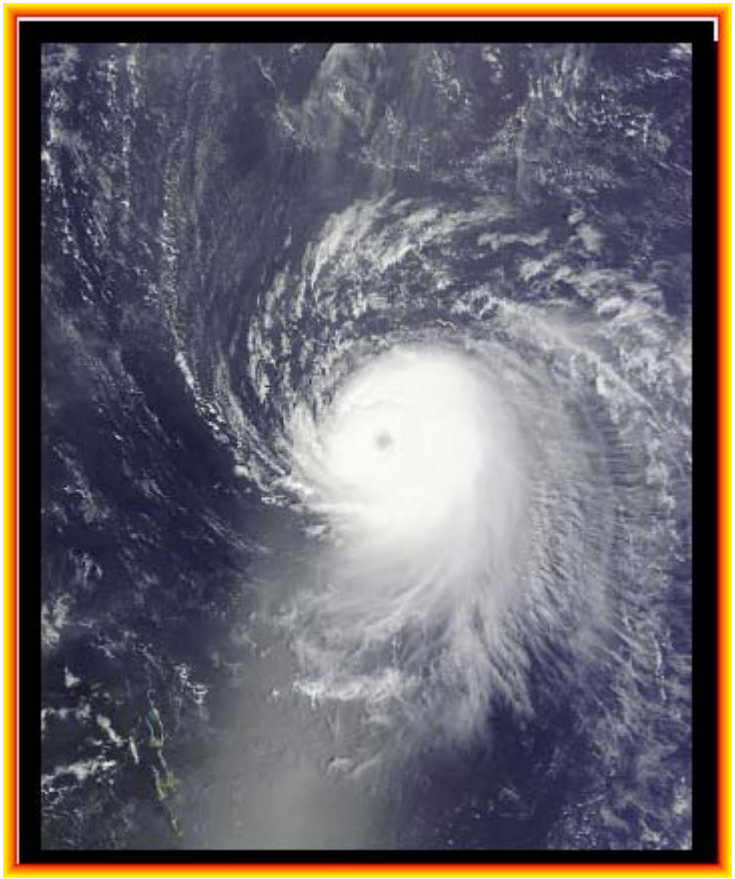
On 10 September, US President George W Bush made an emergency declaration for Texas in advance of Hurricane Ike, making more federal help available for preparations and evacuations.

State rural water associations activated mutual aid networks to prepare for the landfall of Hurricane Hanna and Hurricane Ike while still providing assistance to areas impacted by Hurricane Gustav. The Texas Rural Water Association held meetings with state agencies on Tuesday, 9 September, to plan for landfall along the Texas gulf coast.

On 11 September, forecasting models began to show Ike making landfall just south of Galveston. City Manager Steve LeBlanc issued a mandatory evacuation order late Wednesday for the low-lying west end of Galveston Island. Later, the mandatory evacuation order was extended to the entire island of Galveston, as well as low-lying areas around Houston, Texas.

Also on 11 September, at 20:19, the National Weather Service in Houston/Galveston, issued a strongly worded bulletin, regarding storm surge along the shoreline of Galveston Bay. The bulletin advised that residents living in single-family homes in some parts of coastal Texas may face "certain death" if they do not heed orders to evacuate. Reports said as many as 40 percent of Galveston's citizens may have not paid attention to the warnings. It was feared to be much the same in Port Arthur.

Hurricane Ike was the ninth named storm, fifth hurricane and third major hurricane of the 2008 Atlantic hurricane season. The satellite image below shows Hurricane Ike at peak intensity.



1.2.1 Give ONE similarity, visible in Figure 1.3A, between tropical cyclones in the South Indian Ocean and hurricanes in the West Indies. (1x2)

1.2.2 Explain the point of origin of both tropical cyclones and hurricanes. (3x2)

1.2.3 Very intense hurricanes, such as Ike, occur more often and more regularly. Many meteorologists link the latter with global warming. Why is this so? (3x2)

1.2.4 With reference to Figure 3A, give one reason why tropical cyclones seldom hit the coast of southern Africa. (1x2)

1.2.5 Should a tropical cyclone and a hurricane of similar strength hit the coastlines of southern Africa and the United States of America respectively, the United States of America would suffer more damage to infrastructure, while southern Africa would experience more loss of life. Write a short essay (no more than 12 lines) to explain why this is the case. Your answer should refer to the level of development in the two regions respectively.

Answer to the exam question:

1.2.1 Develop along the east coast ✓✓
Latitudinal position similar ✓✓
Move away from equator ✓✓
Move east to west ✓✓
[Any One]

1.2.2 Originate between 5°- 25°N and S ✓✓
Need Coriolis force that comes into operation at 5° ✓✓
Coriolis force does not exist at equator ✓✓
Situated over hot oceans ✓✓
Greatest evaporation between 5°- 25° N and S ✓✓
Latent heat needed for development stored in water vapour ✓✓
[Any Three]

1.2.3 Global warming increases temperatures ✓✓
Ocean temperatures increase and stay warmer for longer ✓✓
Increased temperatures increase evaporation and condensation ✓✓
Leads to the release of more latent heat ✓✓
Leads to deepening of the low ✓✓
More intense hurricanes developing more often ✓✓

[Any Three]

1.2.4 Southern Africa is shielded/ protected by Madagascar✓✓
Tropical cyclones dissipate over Madagascar ✓✓
Steered away by South Indian Anticyclone/ High Pressure ✓✓
[Any One]

1.2.5 **United States of America**
USA is a developed nation ✓✓
USA has more and better ✓✓
More can be damaged ✓✓
Warning systems are readily available ✓✓
Earlier evacuations can take place ✓✓
Better rescue services ✓✓
Health facilities are more readily available ✓✓
Less loss of life ✓✓

Southern Africa
Southern Africa has little and poorly developed ✓✓
Less can be damaged ✓✓
Warning systems are not able to reach the majority of the population as some of them are in deep rural areas ✓✓
Few early evacuations can take place ✓✓
Not enough rescue services ✓✓
Few health facilities are available ✓✓
More loss of life ✓✓
[To discuss Any Three from USA and Any Three from Southern Africa]

Additional examples to practise:

1. In a **Low**, air generally exhibits ascending motion. The rising air experiences (increasing, decreasing) atmospheric pressure. The ascending air (expands, is compressed) and its temperature (increases, decreases). x6

2. Most clouds form by the cooling of air. Air is sufficiently cooled, will become saturated with water vapour. Continued cooling will result in condensation, cloud formation, and possible precipitation. The vertical motion in a (High, Low) often leads to cloud formation. x2

3. Mid-latitude cyclones are also known as ------? x2

4. What do you understand by the term **cyclone family**? x2

5. What force is a prerequisite for the development of a tropical cyclone? x2

6. Explain why the eye of a tropical cyclone is calm and clear? x2

7. What is the source of energy for the development of a tropical cyclone? x2

8. Why do tropical cyclones die out when they reach over the land? x4

9. Why is there no formation of tropical cyclones between 0° - 5° N/S? x2

Answers to practice examples:

1. decreasing ✓✓ 2

   expands ✓✓ 2

   decreases ✓✓ 2

2. Low ✓✓ 2

3. Temperate cyclones, extra-tropical cyclones or frontal depression ✓✓ 2 (any one)

4. A series of cyclones that pass over a particular area in quick succession. ✓✓ 2

5. Coriolis force. ✓✓2

6. In the eye of a tropical cyclone, air is subsiding due to the upper air divergence. ✓✓ 2
   There is no condensation and as a result, no clouds or rainfall. ✓✓ 2

7. Latent heat released during condensation. ✓✓ 2

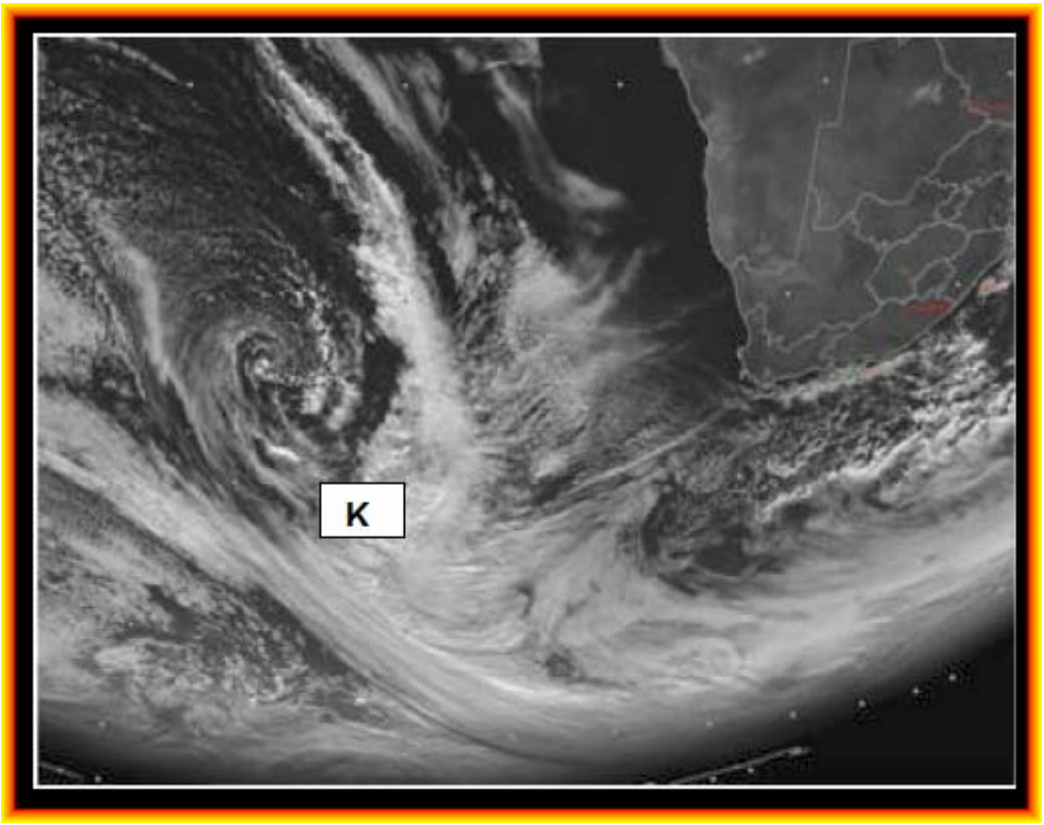
8. Because of the friction created by the rough land surface (e.g. trees and buildings). ✓✓ 2

   Drier, cooler air enters the system, reducing the amount of condensation and therefore the amount of energy. ✓✓ 2

9. There is no coriolis force between 0° - 5° N/S of the equator. Therefore the winds cannot rotate to form tropical cyclones. ✓✓ 2

Additional examples to practise:

Refer to the satellite image below (Figure 2.3), showing the position of an approaching low-pressure system west of South Africa; and Read the accompanying weather forecast before answering the questions that follow.



Satellite image showing the approaching low-pressure system on Monday the 30th June 2008 (Image courtesy Eumetsat, 2008).

KEEP YOUR WINTER WOOLIES OUT (Tuesday, 1 July 2008)

Nice clear skies with cool temperatures can be expected for Tuesday and Wednesday, but people in the Western Cape need to brace themselves for another few cold, wet and windy days from Thursday the 3rd of July 2008.

The South African Weather Service has been issuing advisories for this approaching system since the beginning of the week. On Thursday gale-force northerly to north-westerly winds are expected between Cape Columbine and Cape Agulhas, accompanied by very rough seas, with wave heights in excess of 5 m. Very cold conditions over the western interior of the Western and Northern Cape, spreading to the northern interior of the Eastern Cape and southern Free State, can be expected.

The colder conditions are expected to reach the north-eastern parts of the country on Saturday, with temperatures falling into the cold category.

Isolated heavy falls of rain, which could lead to localised flooding, are expected over the Peninsula, Boland and Overberg areas on Thursday and Friday.

The South African Weather Service appeals to the public to forward to them any reports or confirmation of significant weather events such as snowfalls, hailstorms, heavy rain, damaging winds etc, when they are observed. Such information can also be used for further research, which will contribute to the improvement of weather predictions for that particular area.

2.3.1 Identify the low pressure system labelled K on the satellite image in

Figure 2.3 (2)

2.3.2 During which season does the above-mentioned low-pressure system usually affect the weather of South Africa? (2)

2.3.3 Give the general direction of the movement of the low-pressure system usually mentioned in 2.3.1 (2)

2.3.4 Give one reason for direction of the movement of the low-pressure system as mentioned in 2.3.3 (2)

2.3.5 Draw a sketch map of the low pressure system appearing in the satellite image above; indicating its position in relation to South Africa. (3x2)

2.3.6 Why is it important for the South African weather service to issue weather warnings? Use the source above to write a short essay (no longer than 12 lines), clearly indicating the value of weather forecasts and warnings. In your answer also indicate how reports forwarded by the public can improve weather forecasts. (6x2)

Answers to practice examples:

2.3.1 Midlatitude / temperate cyclone / midlatitude depression ✓✓

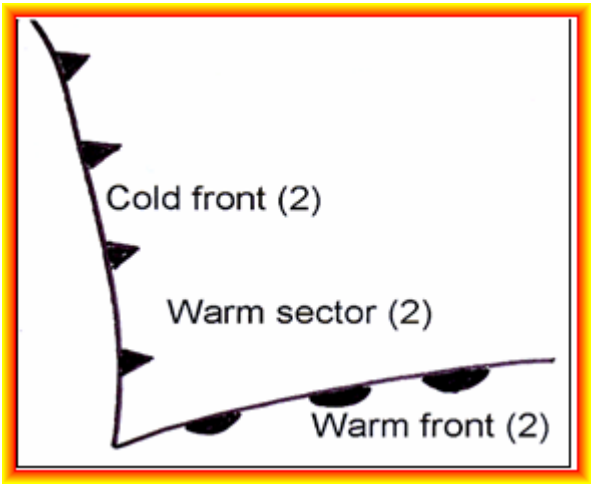
2.3.2 Winter ✓✓

2.3.3 West to east/ eastward/ to the east ✓✓

2.3.4 Situated in the westerly windbelt ✓✓

Driven by the westerly winds ✓✓

2.3.5



2.3.6 **Value of weather forecasts and warnings:**

To timeously alert people ✓✓

Possible precautionary measures can be taken ✓✓

Evacuation can take place ✓✓

Preparation can be done in terms of protection for harsh weather✓✓

Fishermen will know not to go on the sea ✓✓

Cancel outdoor activities ✓✓

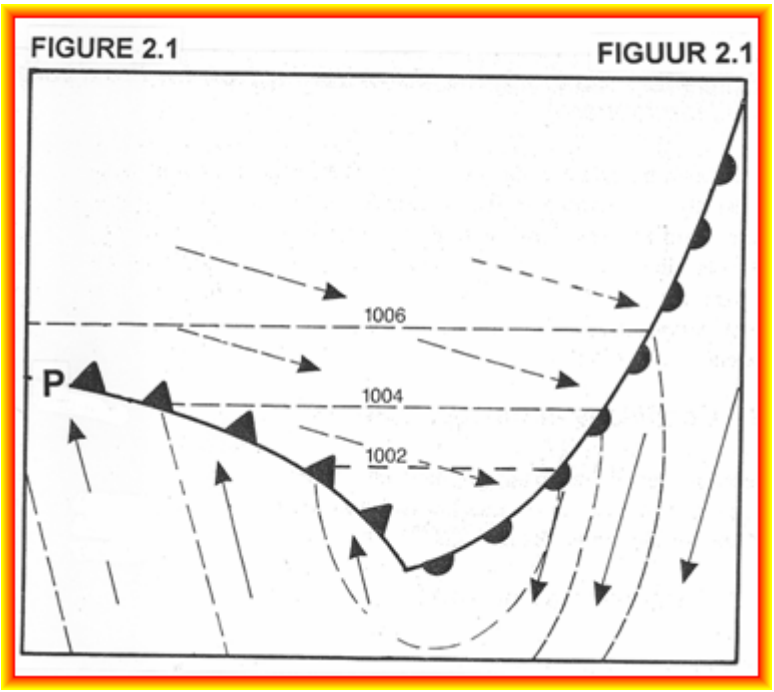
Rescue services alerted beforehand ✓✓

Tourists can adjust their plans ✓✓

[Any other reasonable answer] ✓✓

Additional examples to practise:

Refer to Figure 2.1 below, illustrating a weather system that develops west of Cape Town. Choose the correct term from those given in brackets to make all the statements below True. Write only the word/term next to the question number (2.1.1-2.1.5)



2.1.1 The sketch illustrates a (tropical/ mid-latitude) cyclone. (2)

2.1.2 The weather system illustrated in Figure 2.1 is in the (mature/ occlusion) stage of development. (2)

2.1.3 Air rotates (anticlockwise/ clockwise) around the centre of the weather system. (2)

2.1.4 This weather system generally passes over Cape Town during (winter/ summer). (2)

2.1.5 The front labelled P is the (cold/ warm) front. (2)

Answers to practise examples:

2.1.1 Mid-latitude ✓✓

2.1.2 Mature ✓✓

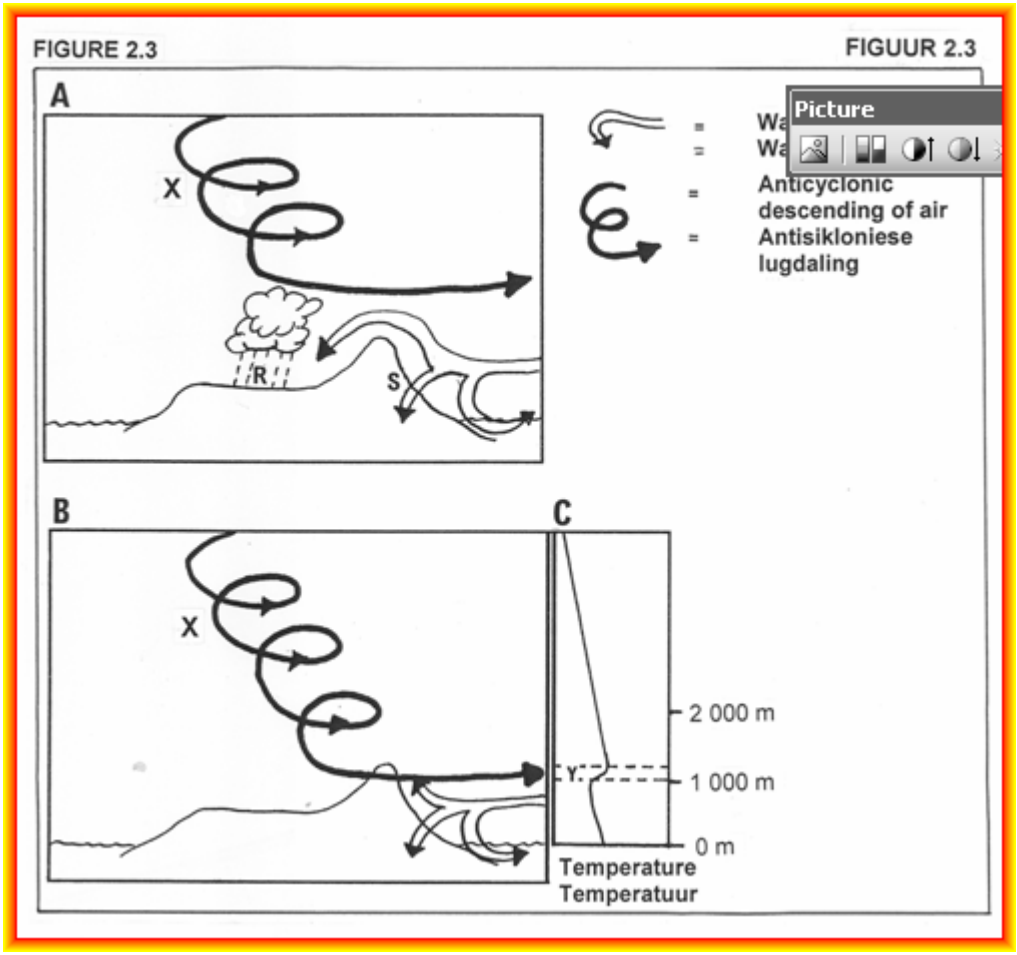
2.1.3 Clockwise ✓✓

2.1.4 Winter ✓✓

2.1.5 Cold ✓✓

Additional examples to practise:

Figures 2.3A and 2.3B show weather conditions that South Africa experience at different times of the year. Also read the extract on droughts below. If the conditions illustrated in Figure 2.3B persist, South Africa may experience a severe drought.



Hot, dry weather from January to March 2007 wilted crops in southern Africa. The severe drought produced near-record temperatures that, combined with a lack of rainfall, caused extensive crop damage, particularly in western crop areas. In South Africa, the anticipated yield from the corn crop dropped from ten million tons in December to six million tons in April, because farmers couldn't plant in the dry conditions and many of the crops that were planted, wilted in the dry heat. The last South African drought of this magnitude occurred in 1992.

The CSIR said, "The 1982-'83 and 1991-92 droughts were the most severe meteorological droughts of the 20th century in southern Africa." In the 1991-'92 drought, 70% of the crops failed. It was estimated that half of the population in the affected area was at risk of malnutrition, other related health problems, and even starvation.

2.3.1 During which season would South Africa experience the weather conditions represented in A and B respectively? (2x2)

2.3.2 Name the weather system labelled **X** on both diagrams. (2)

2.3.3 Weather system **X** is responsible for the development of stable conditions which frequently occur over the South African interior during winter. Briefly explain why weather system **X** is responsible for the development of the stable conditions over the interior. (2x2)

2.3.4 In which one of the diagrams, **A** or **B**, is the above-mentioned condition clearly visible? (2)

2.3.5 Figure 2.3C is a graph showing the vertical temperature gradient as experienced in Figure 2.3.B.

(a) Describe the temperature changes as shown on the graph in figure 2.3C. (2x3)

(b) What is the zone labelled **Y** known as? (2)

2.3.6 What is a drought? (2)

2.3.7 Explain why the persistence of the condition illustrated in Figure 2.3B can result in drought over the South African interior.(3x2)

2.3.8 Write a short essay (no longer than 12 lines) in which you discuss measures that can be introduced to educe the effect of persistent droughts in South Africa. Also give reasons why it is important to reduce the effect of persistent droughts. (6x2)

Answers to practise examples to:

2.3.1 A = summer ✓✓

B = winter ✓✓

2.3.2 Kalahari / Continental High Pressure Cell ✓✓

2.3.3 Descending air ✓✓

Air warms adiabatically as it goes down✓✓

Blocks moisture ✓✓

No condensation will occur ✓✓

[Any two]

2.3.4 B ✓✓

2.3.5 (a) From 0 to 1000 m there is a decrease in temperature with height ✓✓

At Y there is an increase in temperature with height ✓✓

Above Y there is a decrease in temperature with height ✓✓

(b) Temperature inversion ✓✓

2.3.6 A period when rainfall is below average for a region during which vegetation cover decreases. ✓✓

2.3.7 Kalahari HP remains lower than the escarpment ✓✓

Moisture is blocked from the ocean to reach the interior ✓✓

The Kalahari HP is associated with stable air ✓✓

Rainfall will decrease over the interior ✓✓

If the stability of air persists the interior will experience dry conditions over a period of time ✓✓

2.3.8 **<u>Prevention measures</u>**

Plant trees to reduce run-off and increase infiltration ✓✓

Eliminate alien trees which use high quantities of water ✓✓

Build dams in areas with low evaporation ✓✓

Contour ploughing to reduce run-off/ apply scientific ploughing techniques ✓✓

Limit irrigation in dry areas/ less wasteful irrigation techniques ✓✓

Water transfer schemes to increase water ✓✓

Recycling of water for re-use ✓✓

Conserve underground water supplies ✓✓

Decentralisation of activities away from one major water source ✓✓

Public awareness campaigns on importance of using water sparingly ✓✓

[Any Three]

<u>Importance of introducing preventative measures</u>

Droughts reduce yields of crop farmers ✓✓

Reduction in number of livestock ✓✓

Negative implication for exporting ✓✓

Farmers suffer economically ✓✓

Farm workers laid off ✓✓

Fewer raw materials for industries ✓✓

Unemployment rises ✓✓

Balance of trade affected negatively ✓✓

[Any Three]

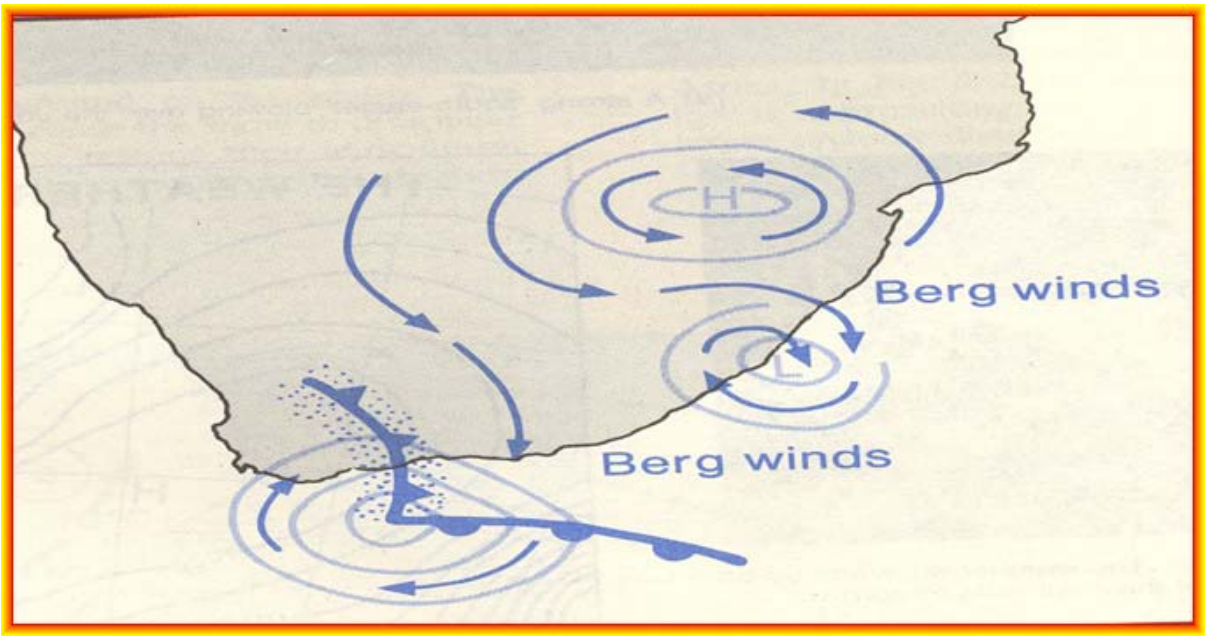
Concepts:

Berg winds

These are very hot and dry winds that blow mostly during winter and autumn towards the coastal areas. They are caused by descending winds from a high pressure cell that has developed in the north eastern interior. As the winds descend over the inland plateau towards the coast, the air becomes compressed and warms adiabatically. These dry, hot winds can be terminated with the passage of a cold front. Conditions can lead to cold, overcast and wet weather within the next 24hrs.

Effects of berg winds
- Increases the temperature of the coastal areas
- decreases the atmospheric humidity
- development of run-away fires increases

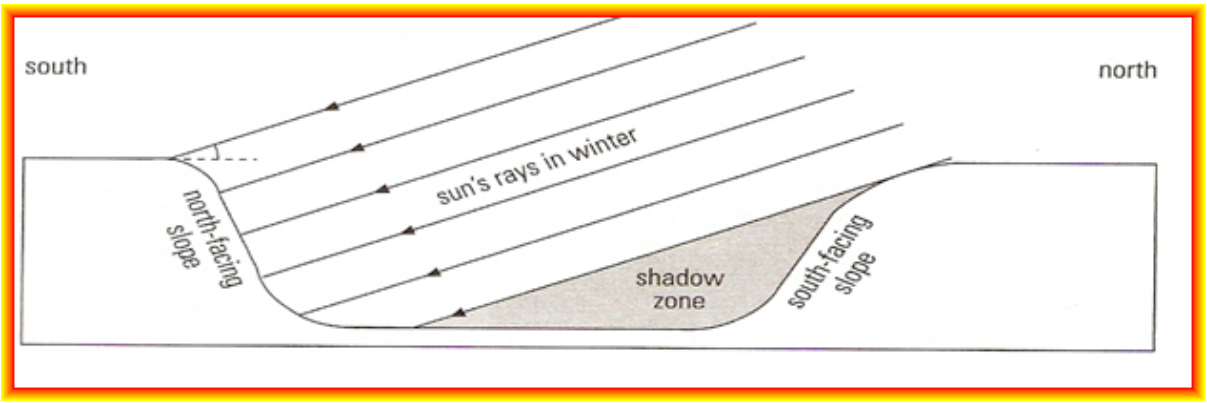
Identifying berg wind on a synoptic map



Aspect

- The angle at which the sun's rays strike a slope.
- In the southern hemisphere, the north-facing slopes receive more sunshine than south-facing slopes.
- Therefore south-facing slopes are in the shadow zone (see diagram below).
- In the northern hemisphere, the south-facing slopes are warmer.

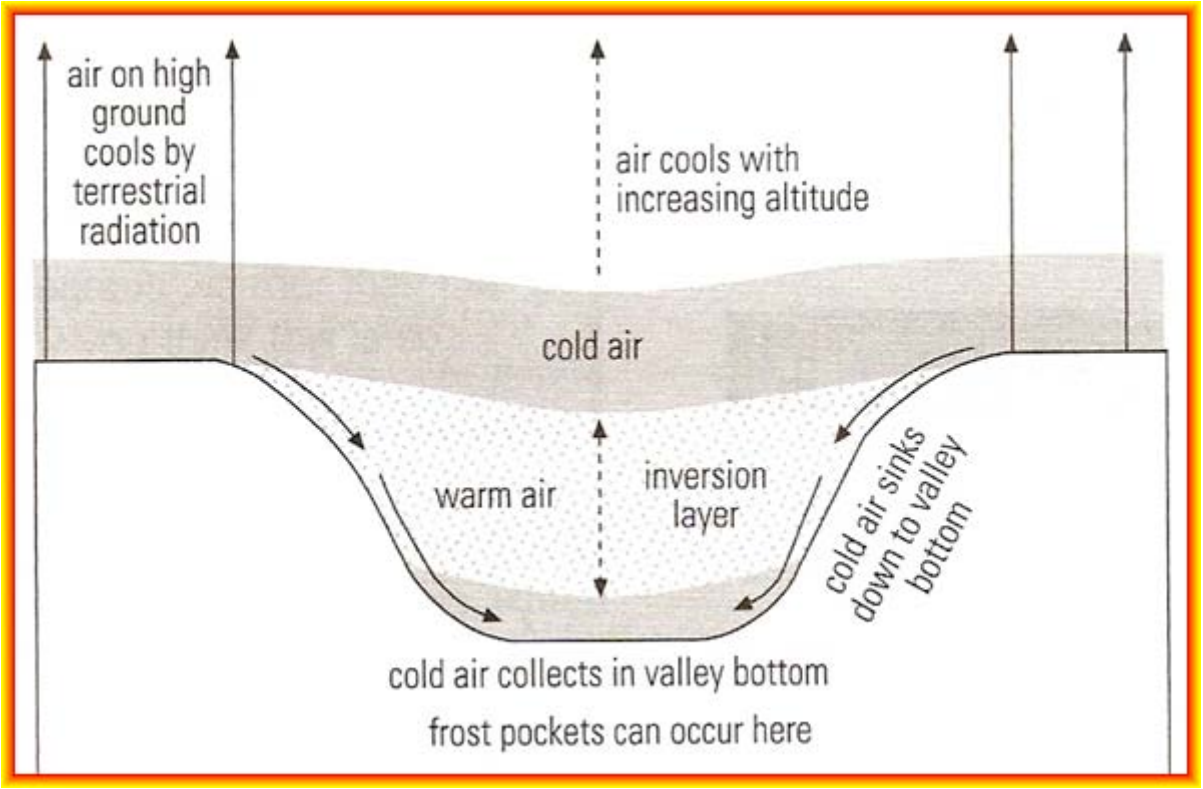
Slope aspect in the Southern Hemisphere



- Aspect has an important effect on the temperatures in different parts of the valley.
- In the southern hemisphere soils on northern slopes are drier because moisture evaporates faster.
- Soils on cooler south-facing slopes retain moisture as they are on the shadow zone.
- Farmers have to select a slope which is best suited for certain crops. For example, grapes would be planted on north facing slopes because they like hot, sunny weather.
- Also note that humans tend to build their houses on north-facing slopes in the southern hemisphere because they are warmer.
- Vegetation is sparse on warmer slopes and dense on cooler slopes.

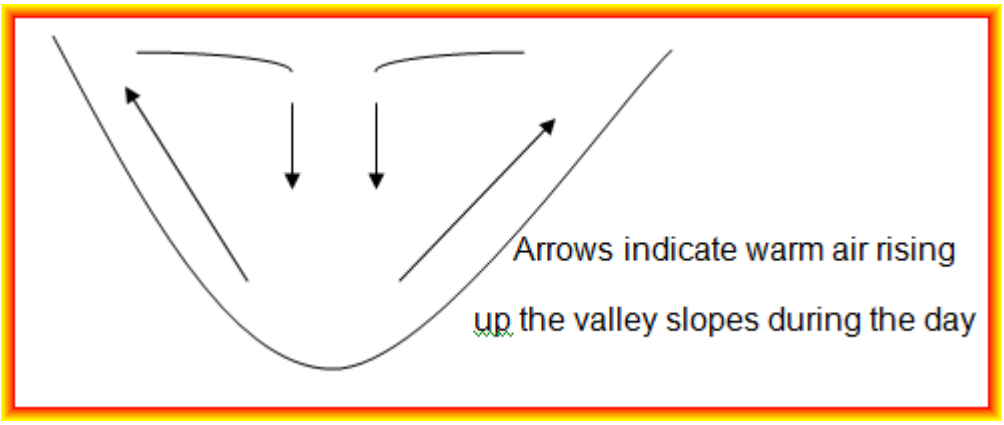
Temperature Inversion

- The increase in temperature as one goes up higher into the atmosphere, especially in a valley.
- The air on the high ground at the sides of the valley cools down quickly due to terrestrial radiation.
- The cool air drains down the valley sides and collects at the bottom of the valley floor, displacing the warm air that was there.
- The warm air will rise leaving the cold air below causing temperature inversion where temperature rises with height.
- The collected cold air at the valley bottom may cause frost pockets because the temperature can fall below freezing point (see diagram below).
- The effects of temperature inversion on agricultural activities is that a farmer will cultivate frost resistant crops for example sugar, beet and wheat.
- The effect of temperature inversion on industrial development is that pollutants given off by heavy industries are trapped in the valley at night.
- It is therefore advisable to build light industries in the valley since they do not release pollutants.



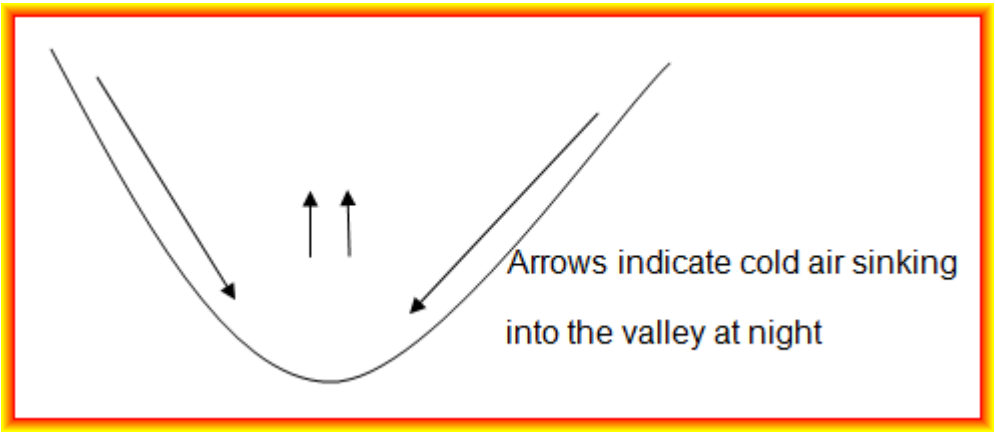
Valley winds / Anabatic winds/ Upslope-

- These occur during the day.
- The sun's rays heat up the valley slopes during the day
- The warm, light air above the slope rises up the slope
- Anabatic air is important because it assists in releasing the pollutants from the valley.



Mountain winds/ Katabatic winds/ Downslope winds -

- Katabatic winds occur after midnight, especially if it is a cold, clear and calm night.
- The mountain tops cool rapidly at night through terrestrial radiation.
- The air above slope becomes cold and dense, and gravity causes it to move down slope.



Heat Island

When the city is warmer than the surrounding rural areas.

Why the city is warmer tan the surrounding rural area:

- Artificial substances such as concrete, glass, bricks and tar absorb more heat
- Artificial sources of heat, domestic and industrial heating
- Pollutants above the city trap the heat from escaping
- Tall buildings that absorb heat that would be reradiated into the air making the city warmer.

Heat island can cause heat stress that can cause heart problems of many urban dwellers; especially deaths of elderly people. The cloud of smog resident in urban atmosphere does reduce visibility, especially in winter; causing more road accidents. This cloud also traps poisonous pollutants that affect the quality of the air we breathe, resulting in respiratory diseases. Poisonous pollutants may also cause eye infections and skin irritation especially for people with allergies. Furthermore,

pollutants may cause acid rain which may either kill certain plants or retard growth in certain species.

Exam question based on the concepts explained above:

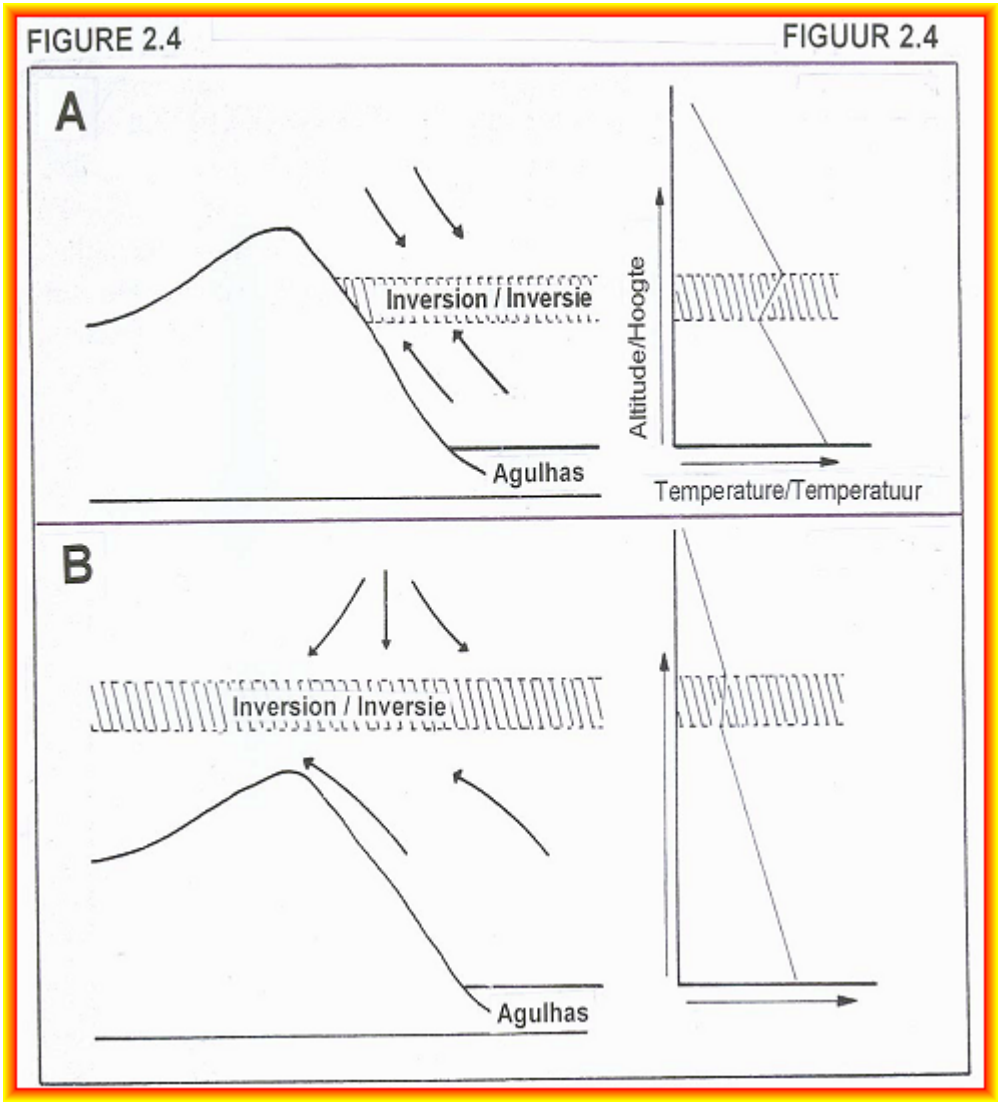
The Kalahari high-pressure cell causes a subsidence inversion over the South African interior. The base height of this subsidence inversion varies from summer to winter. Study FIGURE 2.4 below, a cross-section that shows how the base height of the subsidence inversion varies from summer to winter.

2.4.1 Define the term *temperature inversion.* x2

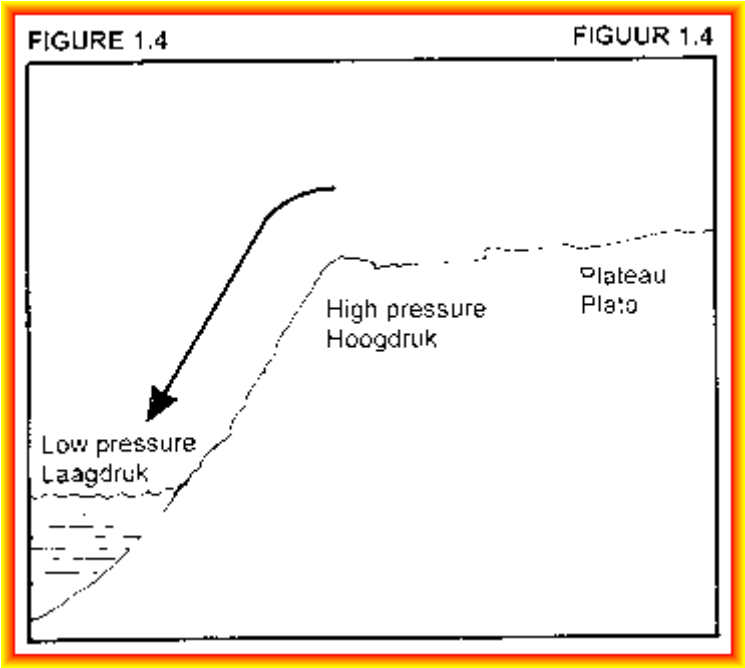
2.4.2 Which of the diagrams, Figure 2.4A or 2.4B, represents summer months? x2

2.4.3 Give one reason for your answer to Question 2.4.2. x2

2.4.4 Describe the effect that the base height of the subsidence inversion will have on the climate of the South African interior during summer and winter months respectively. 4x2



3.1 Refer to Figure 1.4 which is a cross-section showing a berg wind that often occurs along the south coast of South Africa and your knowledge to answer the questions below.



3.1.1 Identify the type of low pressure, visible in Figure 1.4, which plays a role in the development of berg winds. X2

3.1.2 Explain why berg winds will result in warm, dry conditions along the south coast of South Africa? 3x2

3.1.3 Veld fires often accompany berg winds. Give one preventative measure that can be introduced to reduce the spreading of veld fires. x2

3.1.4 Which weather system is responsible for the dissipation of berg wind conditions? x2

Answer to the exam question:

2.4.1 A rise/ increase in temperature with increase in height/ altitude. ✓✓

2.4.2 2.4B. ✓✓

2.4.3 Inversion layer is above the escarpment. ✓✓
The base of the inversion is higher above sea level ✓✓
Moist air is adverted onto the plateau ✓✓

2.4.4 **Summer**
Moist air will reach the interior✓✓
High humidity ✓✓
More condensation ✓✓
Cloud formation ✓✓
Precipitation ✓✓
[Any two for Summer]

Winter
Moist air prevented from reaching the interior ✓✓
Low humidity ✓✓
Little condensation ✓✓
No/ few clouds ✓✓
Colder night temperatures ✓✓
Frost may occur ✓✓
[Any two for Winter]

3.1.1 Coastal Low ✓✓

3.1.2 Air descends the plateau; and ✓✓
Warms adiabatically ✓✓
It is dry since it is an offshore wind✓✓
It decreases atmospheric humidity ✓✓
[Any three]

3.1.3 Fire breaks ✓✓
Early warning over weather reports ✓✓
Public education ✓✓

3.1.4 Mid-latitude cyclone ✓✓

An additional example to practise:

1.1.1 Explain why the earth's surface looses heat at night. x 2

1.1.2 What do we call an increase in temperature with altitude? x 2

1.1.3 Explain why lower temperatures form in the valley and give a term for such. x 4

1.1.4 Account for the warmer slope temperatures in comparison with the lower temperatures in the valley. X4

1.1.5 Explain how temperatures have influenced the location of traditional settlements hilly areas of South Africa. X4

1.1.6 Explain why the central urban area is constantly warmer than the rural area? x 2

1.1.7 Account for the poor health conditions of people living in cities as a result of climate. X4

1.1.8 If you were a crop farmer how would you plan your planting areas? X4

Answer to practice example:

1.1.1 Because during the night there is no absorption of heat energy from the sun; instead the land looses heat through long wave radiation, making it to be cooler than the air above it. ✓✓✓✓

1.1.2 Temperature inversion ✓✓

1.1.3 The katabatic flow sinks into the valley after sunset making it to be cold within the valley. The cold air collects to form a frost pocket leading to temperature inversion as the air above would be relatively warmer. ✓✓✓✓

1.1.4 The thermal belt is situated above the level of the frost pocket because heavy cold sank below and lighter warm air is situated at the upper slope levels. ✓✓✓✓

1.1.5 Mostly situated on the thermal belt on north facing slopes because of warmer conditions and exposure to sun. ✓✓✓✓

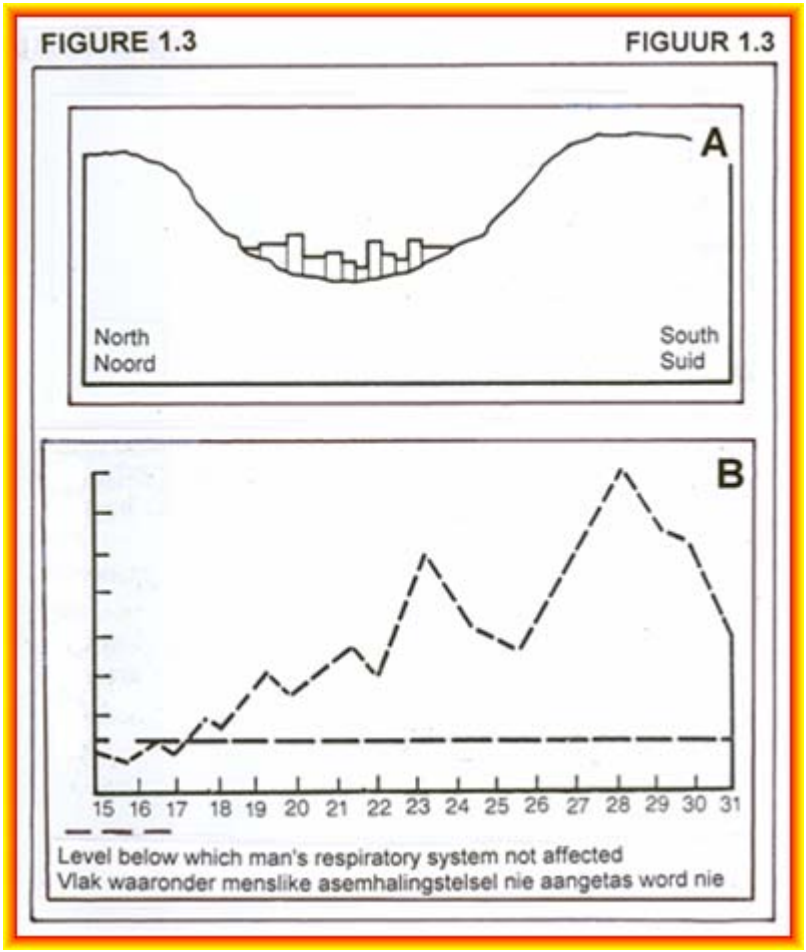
1.1.6 -artificial surfaces that absorb heat ✓✓
-emission of heat from various sources✓✓
-polluted air and other greenhouse gases retaining heat✓✓
(Any two)

1.1.7 Air pollution leads to abnormal temperature increases and lung disease✓✓✓✓

1.1.8 Valley floors will be used for frost resistant crops and sensitive crops would be planted above frost pocket level. Frequently on north facing slopes ✓✓✓✓

An additional example to practise:

Study Figure 1.3A which is a simplified cross-section of a large city situated on a valley floor somewhere in the Southern Hemisphere; and Figure 1.3B which shows the amount of carbon monoxide (CO) in the atmosphere of the same city during July.



Read the extract below before answering the questions that follow.

> Carbon monoxide is a colourless, odourless gas emitted naturally through volcanic eruptions, forest fires, bacterial activities, et cetera. In cities, unsafe levels may accumulate from incomplete combustion of gas in automobiles. Automobile exhaust in cities can cause as much as 95 percent of all CO emissions. These emissions can result in high concentrations of CO, particularly in local areas with heavy traffic congestion. Other sources include furnaces, home fires, and cigarette smoke. Despite an overall downward trend in concentrations and emissions of CO, some metropolitan areas still experience high levels of CO.
>
> Carbon monoxide is extremely hazardous and long-term exposure to even small concentration can lead to death. Carbon monoxide enters the bloodstream and reduces oxygen delivery to the body's organs and tissues. The health threat from CO is most serious for those who suffer cardiovascular diseases. Healthy individuals are also affected, but only at higher levels of exposure. Exposure to elevated CO levels is associated with visual impairment, reduced work capacity, reduced manual dexterity, poor learning ability, and difficulty in performing complex tasks.

1.3.1 Winds will blow down into the city at night. What are these winds called? 2

1.3.2 Use a clearly labelled (annotated) diagram to explain the development of the winds named in Question 1.3.1 3x2

1.3.3 The winds mentioned in Question 1.3.1 will be responsible for the high concentrations of CO measured over the city during July. Explain how these winds and the topography of the landscape contribute to these high levels of CO. 3x2

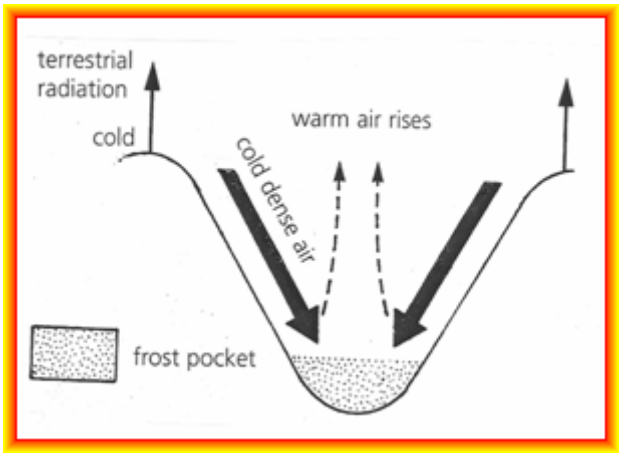
1.3.4 For how many days in July was CO pollution above the level at which it influenced people's health? x2

1.3.5 It is clear that CO pollution levels are unacceptably high over large cities. Write a short essay (no more than 12 lines) to outline reasons why a concerted effort should be made to reduce CO levels over large cities. In your essay also provide solutions that are geographically sound, to reduce CO levels over large cities. 6x2

Answer to practice example:

1.3.1 Katabatic/ downslope/ gravity winds ✓✓

1.3.2



1.3.3 Air sinks down the valley slopes ✓✓
Inversion forms close to the valley floor ✓✓
Inversion lower than the surrounding hills ✓✓
Carbon monoxide trapped in valley below the inversion ✓✓

1.3.4 14 ✓✓

1.3.5 **Reasons to reduce CO levels**

CO poses a health risk to city residents ✓✓
Reduces oxygen delivery to the body's organs and tissues ✓✓
May affect eyesight negatively ✓✓
Reduce work capacity of individuals ✓✓
Reduce manual dexterity ✓✓
Lead to poor learning ability and poor performance ✓✓
Individuals may find it difficult to perform complex tasks✓✓

Solutions
Plant more trees ✓✓
Build chimney stacks higher than the inversion ✓✓
Filters to trap pollutants ✓✓
Limit industrial activity at night ✓✓
Electrification of all houses ✓✓
Laws controlling pollution ✓✓
Community education ✓✓
Fines ✓✓
Encourage use of unleaded petrol ✓✓
Encourage use of public transport ✓✓
Reduce number of cars coming into city ✓✓

Concepts:

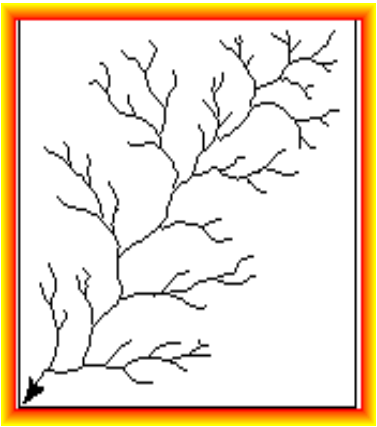
Drainage Basin

The area drained by a river and its tributaries. It may also be defined as the total surface area from which a river and its tributaries obtain their water. Two river systems may be divided by a high lying area called a **drainage divide** or a **watershed.** Examples of drainage basins in South Africa are the Orange River Drainage Basin and the Tugela River Drainage Basin. The source of water supply in a drainage basin may come from melting snow, rainfall, spring, fountains, geysers and artesian wells.

Drainage Patterns

There are various patterns in which streams in a drainage basin can be arranged, namely:

a) dendritic pattern



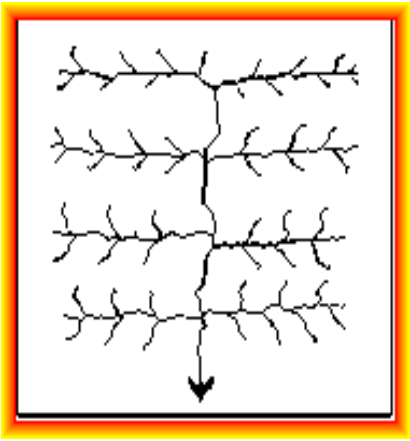
-this pattern is tree-shaped and occurs in rocks that are uniformly resistant to erosion.

- tributaries join the main river at acute angles.

-occurs in horizontal sedimentary rocks, massive igneous rocks and metamorphic rocks.

-slope is uniform.

b) trellis pattern



-main streams are more or less parallel to each other.

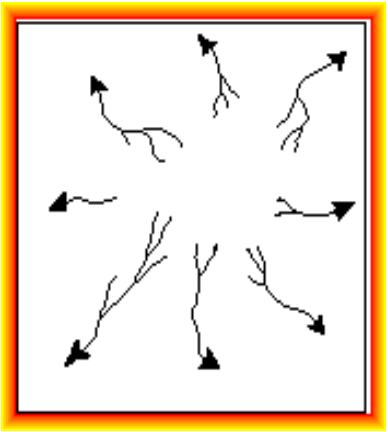
-short tributaries join the main stream at right angles.

-there are alternate layers of hard and soft rock and in areas

-It occurs in places where there are inclined rock strata (where folding has taken place).

-It also occurs in areas where faults occur parallel to one another.

c) radial pattern

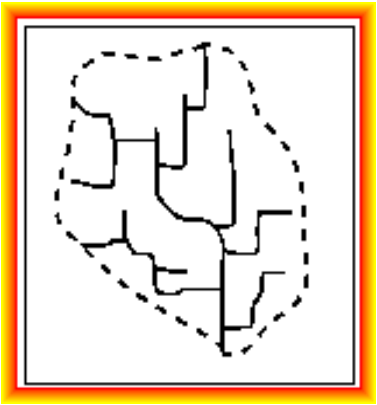


-This pattern occurs on a dome or volcano.

-streams radiate outwards from a central high lying area.

-It thus associated with massive igneous rocks.

d) rectangular pattern



-the rectangular pattern is found in regions that have undergone faulting in igneous rocks and in horizontal sedimentary rocks.

- streams follow the path of least resistance and make bends at right angles.

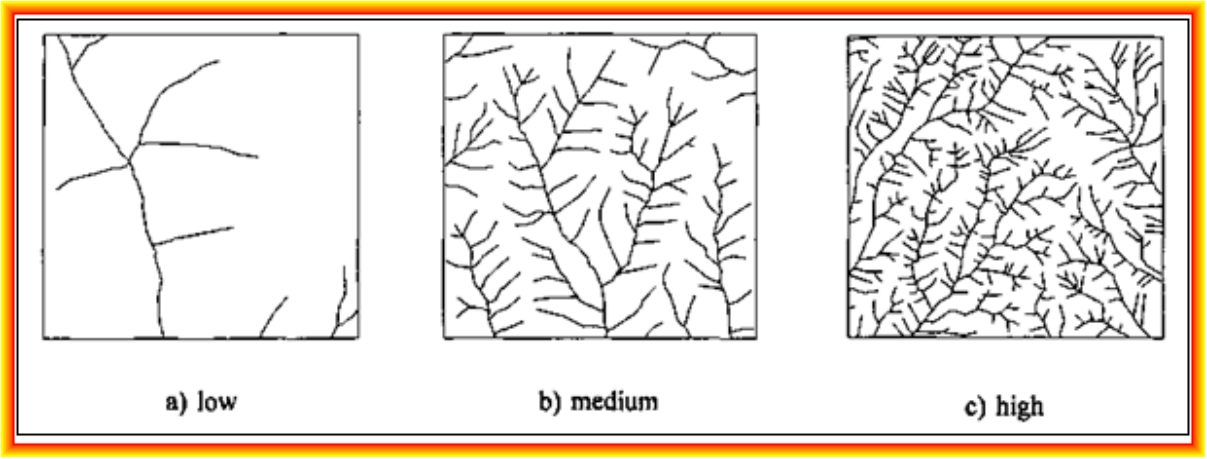
-the tributaries also join the main stream at right angles (90°).

Drainage density

Drainage density refers to the ratio between the total length of all the streams of a given river system and the area drained by them. The formula for drainage density is

$$D = \frac{L \text{ (Total length of all the streams in a drainage basin)}}{A \text{ (Area of drainage basin)}}$$

A drainage basin may have a **low density** (coarse texture), **medium density** (medium texture) **or high density** (fine texture).



Drainage density depends upon both climate and physical characteristics of the drainage basin such as:

-rainfall

-permeability of rocks

-porosity of rocks

-vegetation

-rock type and structure

Impermeable soil will lead to increased surface runoff and therefore more frequent streams.

Hydrograph

Drainage density can affect the shape of a river's hydrograph. A hydrograph is a graph showing variation in a river's runoff at a specific point along its course or a graph showing discharge over a certain period of time. The discharge of a river is the amount of water passing a point in a certain amount of time and measured in cubic metres per second.

When studying a hydrograph note the following:

- discharge of the river before the storm/ rain and after the storm

- time lag (time between the highest rainfall and the flood peak) – is it a short or a long period of time?

- flood peak – whether it is a high peak or a low peak.

- receding limb – whether the flood peak drop off quickly or slowly.

Stream Profile

Cross profile

-a cross profile of a channel is at right angles to the flow of the river

-cross-section of a river from bank to bank

-the cross profile displays the width and the depth of a river

-through this profile the upper course (closed V-shaped), middle course (more open V-shaped) or lower course (very flat, open V-shaped), can clearly be distinguished.

Longitudinal profile

-the side view of a river channel from the source to the mouth.

-the longitudinal profile may be **graded** or **ungraded.**

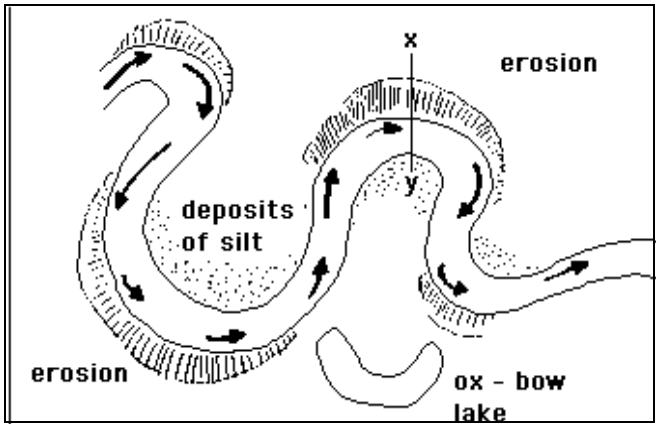
-a **graded** river profile shows a smooth curve which is concave in shape. Obstructive features such as rapids and waterfalls have been removed by the process of erosion in this case. And thus a graded river profile is said to be in a state of **equilibrium**. This means that the rate of erosion is equal to the rate of deposition.

-**ungraded** river profile is uneven or irregular in shape. The unevenness is cause by the presence of obstructive features such as rapids, waterfalls and lakes

Meanders

A meander is a bend, curve or loop in a river. A meander is formed when the moving water in a river erodes the outer bank which is also called the undercut slope Here the water moves faster and thus allowing erosion as the dominant activity. The eroded sediments will be deposited at the inner bank which is also called the slip off slope, because the river flows slowly in this area. It should be noted that the undercut slope is concave in shape while the slip-off slope is convex.

Diagram of a meandering stream



An **ox-bow lake** will form when undercut slopes that are opposite and close to each other are flooded and the meander loop is cut from the main river due to increased energy in the river. The truncated or cut meander loop will from an ox-bow lake. In due coarse the water in the loop will run dry because it does not have contact with the main river and because of evaporation as well.

River capture

River capture is the process whereby one river intercepts the water of another river into its own channel. This process is known as **stream piracy**. The captor stream is usually found on the lower level in a drainage basin and has more energy to erode through the watershed to intercept the captive stream that usually lies on a higher level. River capture can be caused through *headward erosion*, *lateral erosion* or *abstraction of a watershed*.

Features of river capture include the following;

-elbow of capture

-pirate or captor stream

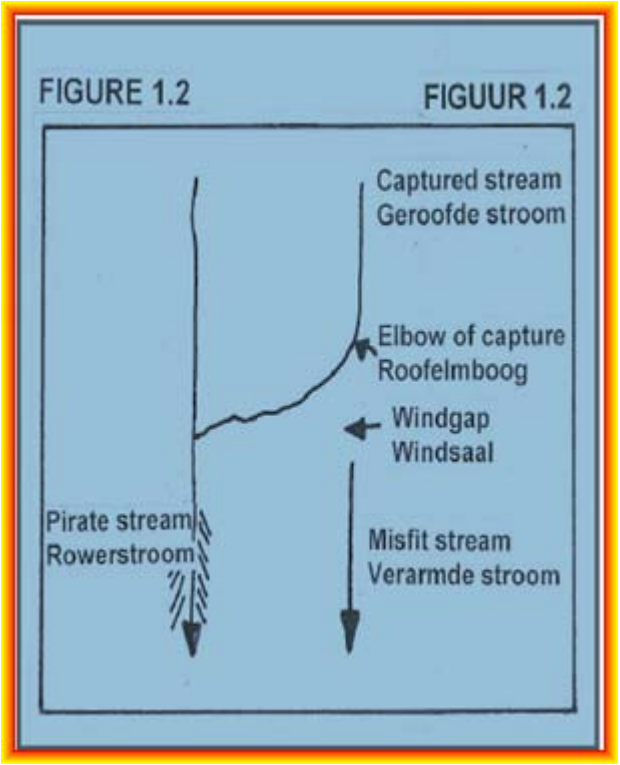
-captured/ captive or beheaded stream

-misfit stream

-wind gap with gravels

Exam questions based on the concepts explained above:

Refer to Figure 1.2 below showing different features of river capture. Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number (1.2.1 - 1.2.5)



1.2.1 A stream that intercepts the water of another stream.

1 2.2 A stream whose headwaters have been intercepted.

1.2.3 A stream that is smaller than the valley through which it flows.

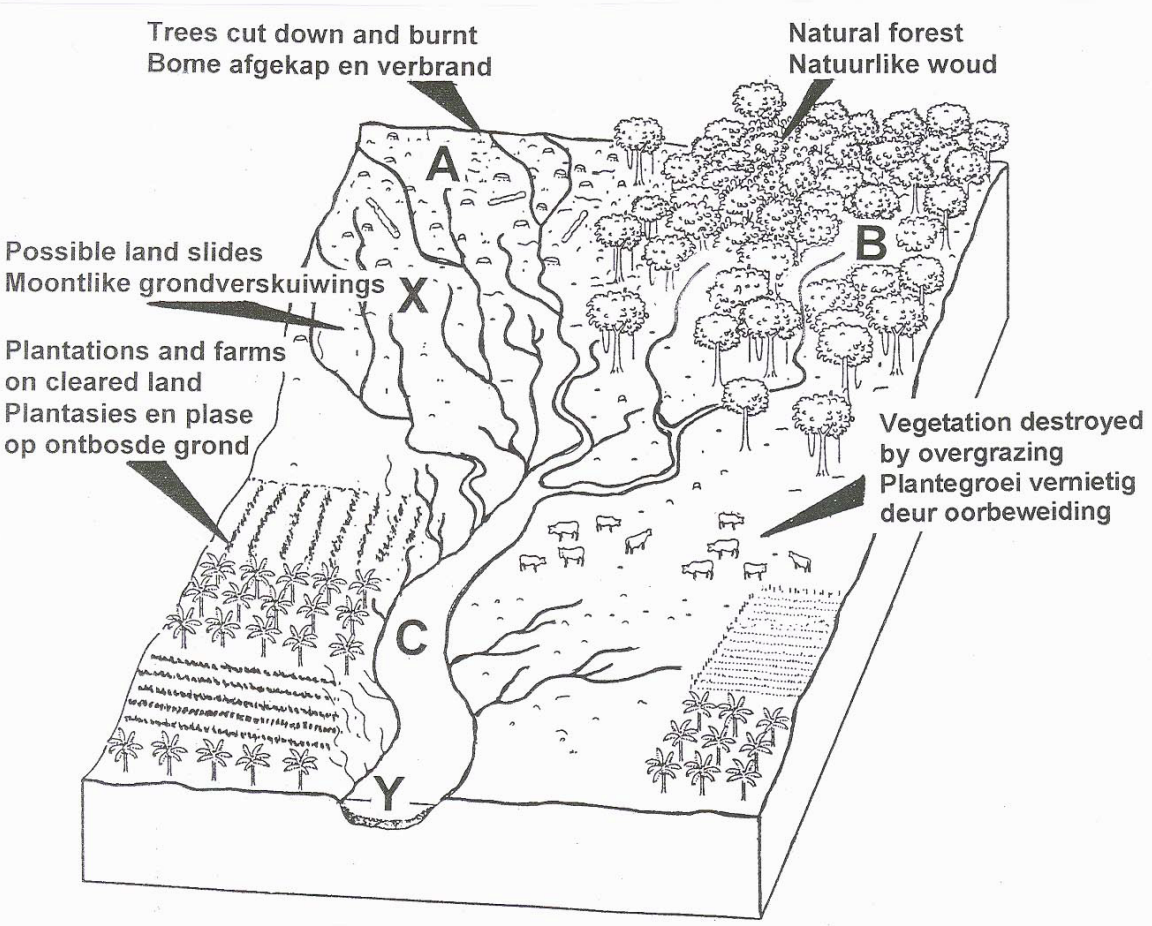
1.2.4 The point where an energetic stream intercepts the water of another stream.

1.2.5 A dry valley where no stream flows.

FIGURE 2.5

DRAINAGE BASIN MANAGEMENT

In hydrology, the drainage basin is a logical unit of focus for studying the movement of water within the hydrological cycle, because the majority of water that discharges from the basin outlet originated as precipitation falling on the basin. A portion of the water that enters the groundwater system beneath the drainage basin may flow towards the outlet of another drainage basin, because groundwater flow directions do not always match those of their overlying drainage network.



Drainage basins are important elements to consider, also in ecology. As water flows over the ground and along rivers it can pick up nutrients, sediment, and pollutants. Like the water, they get transported towards the outlet of the basin, and can affect the ecological processes along the way as well as in the receiving water body.

Modern usage of artificial fertilisers, containing nitrogen, phosphorus, and potassium, has affected the mouths of drainage basins. The minerals will be carried by the river system to the mouth and accumulate there, disturbing the natural mineral balance.

2.5.1 Define the following terms

(a) *drainage basin.* x2

(b) *river system* x2

2.5.2 List and explain Two factors that could influence the run-off in a river 4x2

2.5.3 Identify the drainage pattern assumed by the river system in this drainage basin. x2

2.5.4 Give one reason, visible in Figure 2.5, for your answer to Question 2.5.2. x2

2.5.5 The drainage density of the river system seems to be denser (finer) at A than at B. Explain why this is the case. 3x2

2.5.6 Determine the stream order of the river system where it flows out of the drainage basin at Y. x2

2.5.7 (a) At which point, X or Y, would there be a greater risk of flooding? x2

(b) Explain your answer to Question 2.5.6 (a). 3x2

(c) Outline three flood prevention methods that can be implemented to reduce the risk of flooding in this drainage basin. 3x2

2.5.8 In order to manage a drainage basin, the whole area that is drained by a river, including the tributaries, needs to be taken into consideration. What happens upstream in the tributaries will affect the main river downstream. Conservation of the whole drainage basin must be sustainable, so that future generations can benefit from the water system and its related ecosystems. With reference to Figure 2.5, write a short essay (no more than 12 lines) outlining measures that could be implemented to restore the drainage basin illustrated in figure 2.5 to become a sustainable unit once again. 6x2

Answer to the exam question:

1.2.1 pirate/ captor ✓✓

1.2.2 captured ✓✓

1.2.3 misfit ✓✓

1.2.4 elbow of capture ✓✓

1.2.5 windgap ✓✓

2.5.1 (a) The total area drained by a river and its tributaries ✓✓

(b) The main river and all its tributaries ✓✓

2.5.2 *Nature of rainfall* ✓✓
-Soft rain less run-off; storms more run-off ✓✓
Vegetation ✓✓
-More vegetation less run off, less vegetation more run-off✓✓
Relief of the land ✓✓
-Steep land more run-off; gentle slope less run-off ✓✓
Rock type ✓✓
-Porous and permeable rock will have less run-off; impermeable rock will have more run-off ✓✓
Soil type ✓✓
-coarse sandy soil promotes infiltration; compact soil promotes run-off. ✓✓
Soil moisture content ✓✓
-Saturated soils encourage run-off; dry soils promote infiltration. ✓✓
Evaporation ✓✓
-High evaporation reduces run-off and infiltration; low evaporation increases run-off and infiltration. ✓✓
[Any Two]

2.5.3 Dendritic ✓✓

2.5.4 looks branches of a tree ✓✓
tributaries join at small angles ✓✓

2.5.5 At A there is no vegetation ✓✓
Water is not easily absorbed ✓✓
More run –off occurs ✓✓
Therefore more tributaries ✓✓
At B there is dense vegetation ✓✓
Water is easily absorbed ✓✓
Less run off occurs ✓✓
Therefore fewer tributaries ✓✓
[Any three]

2.5.6 3rd order ✓✓

2.5.7 (a) Y ✓✓

(b) Gentle slope slows flow of water down ✓✓
Flows on a wide floodplain and water spread easily ✓✓
More water from tributaries increases volume of water ✓✓

Deposition makes stream channel shallower ✓✓
[Any three]

(c) Building large dams in lower reaches to control flow ✓✓
Build artificial levees ✓✓
Straighten the river channel to increase gradient ✓✓
Build small dams in the upper reaches and release water at intervals ✓✓
Line the riverbed with concrete to reduce friction ✓✓
Revegetate / protect vegetation ✓✓
Correct farming methods e.g. contour ploughing ✓✓
Avoid building below the flood line ✓✓
[Any three]

2.5.8 **Measures to restore the drainage basin:**
Revegetation and afforestation ✓✓
Intensive use of manure and compost to increase infiltration ✓✓
Avoid ploughing close to the river ✓✓
Use appropriate methods of agriculture e.g. contour ploughing
Terracing slopes ✓✓
Fencing of catchment areas ✓✓
Avoid over grazing ✓✓
Avoid construction on floodplains ✓✓
Legislation on water usage ✓✓
Monitoring of water usage by various economic sectors ✓✓
Protection against soil erosion ✓✓
Protection of ground water supply ✓✓
Adopt drainage management strategies ✓✓
[Any Six]

An additional example to practise:

1.4 Refer to FIGURE 1.4 showing a flow hydrograph for a river.

1.4.1 What is a *flow hydrograph*? 1x2

1.4.2 Explain the following terms indicated on the flow hydrograph:

(a) *Flood peak* 1x2

(b) *Lag time* 1x2

1.4.3 (a) How long was the lag time between the peak of the storm and the flood peak? 1x2

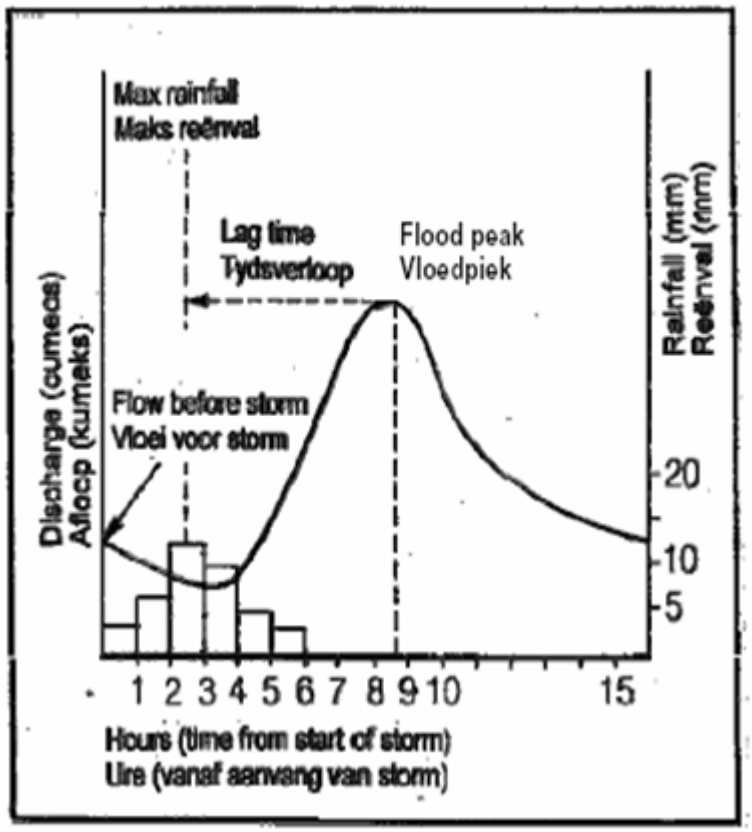
(b) Explain why a lag time exists between the peak of the storm and the flood peak. 1x2

1.4.4 (a) How will the height of the flood peak changes if vegetation cover in the vicinity of this river were to be removed? 1x2

(b) Explain your answer in Question 1.4.4. (a) 2x2

1.4.5 What measures can be introduced to control flooding in the lower reaches of a stream? 2x2

FIGURE 1.4 Hydrograph



Answer to practice example:

1.4.1 A graph showing the amount of discharge in a river at a certain point in time

or

a graph showing discharge of a river per hour at s specific point along the course of river ✓✓

1.4.2 (a) Flood peak is the highest level where water in a river has reached after rainfall ✓✓

(b) Lag time is the time between the highest rainfall and the flood

peak ✓✓

or

Difference in time between rainfall peak and flood peak ✓✓

1.4.3 (a) between 6-6½ hours ✓✓

(b) because water from precipitation will first have to be absorbed into the ground✓✓

and then sheet flow will occur before stream flow ✓✓

1.4.4 (a) It will be higher ✓✓

(b) less infiltration ✓✓

lot of run-off because of no vegetation✓✓

more water to reach the stream ✓✓

level of water will rise in a stream ✓✓

[Any two]

1.4.5 -building of artificial levees or river banks✓✓

-building of catchment dams in lower reaches✓✓

-planting more vegetation cover to increase water absorption ✓✓

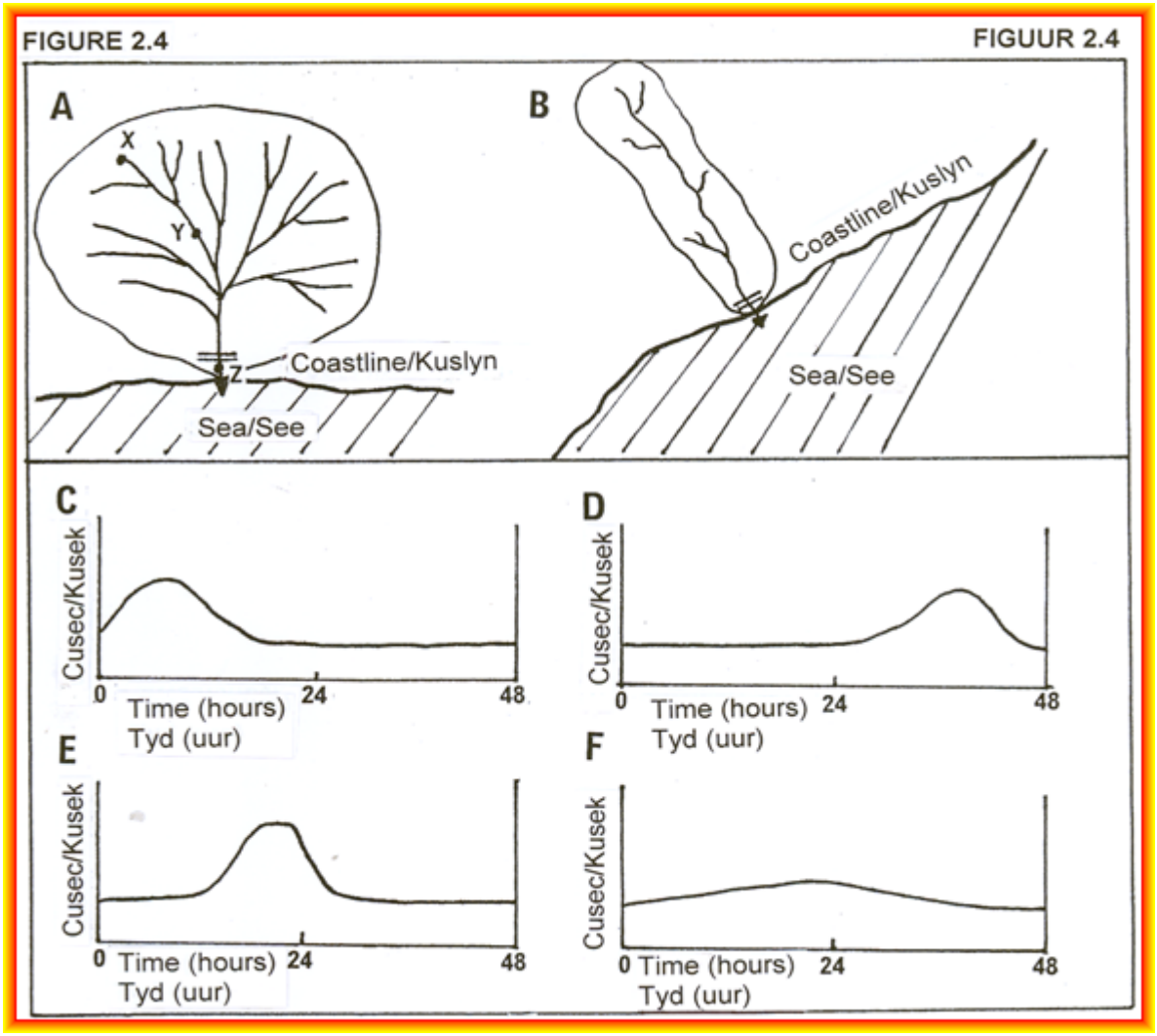
-not building on areas next to the river banks ✓✓

-lining of rivers with cement to reduce friction ✓✓

-cut out meanders to increase gradient and increase velocity ✓✓ [Any two]

An additional example to practise:

Refer to Figure 2.4 representing the drainage basins of two river systems (A and B) and flow hydrographs (C-F) to show run-off in rivers after rain showers.



2.1.1 Identify the shapes of drainage basins A and B respectively. x4

2.1.2 Suppose a rain shower of 100 mm occurs in each of the drainage basins A and B. Which of the flow hydrographs (C-F) will most likely represent stream flow at the point marked = in drainage basin A and B respectively? x4

2.1.3 Give a reason for each of the choices you have made in Question 2.1.2 x4

2.1.4 At which point, X, Y or Z, would be a greater risk of flooding?

2.1.5 Give one reason for your answer to Question 2.1.4. x2

2.1.6 In order to control flooding, a drainage basin must be managed properly. Conservation of the whole drainage basin must be sustainable to reduce the risk of flooding.

Write a short essay (no more that 12 lines) to explain how the sustainable management of drainage basins can reduce the risk of flooding. In your answer also indicate the negative impact of flooding for the local community living in the drainage basin. x12

Answer to practice example:

2.1.1 A = round/ circular ✓✓

B = elongated/ long ✓✓

2.1.2 A = E ✓✓

B = F ✓✓

2.1.3 A- tributaries in this basin reach mainstream at the same time. ✓✓

Water reaches point of outflow at the same time. ✓✓

B- Tributaries in this basin meet the main stream not at the same distance from point of outflow. ✓✓

Water reaches point of outflow at staggered intervals. ✓✓

2.1.4 Z ✓✓

2.1.5 All the water from different tributaries in this basin converges to pass at Z and this can cause flooding. ✓✓

2.1.6 **<u>Sustainable management of a drainage basin</u>**

Build artificial levees/ embankments to contain water ✓✓

Build large storage dams to control flow ✓✓

Plant trees to increase infiltration and reduce run-off ✓✓

Straighten river channels / cut through the meander loops to increase gradient ✓✓

Widen the river channel to contain a greater volume of water ✓✓

Prevent building on floodplains ✓✓

Conserve the wetlands ✓✓

[Any Three]

Negative impact of flooding on local communities

Washes away the crops ✓✓

Reduce the fertility of the soil ✓✓

Increase the rate o soil erosion ✓✓

Triggers mass movements ✓✓

Endanger animal and human life ✓✓

Contaminates drinking water ✓✓

Can cause hunger and starvation ✓✓

Loss of capital income ✓✓

Import food- negative trade balance ✓✓

Higher food prices ✓✓

Leave some people homeless ✓✓

Destruction of communication networks and infrastructure ✓✓

[Any Three]

PART THREE (Mapwork)

The purpose of this section is to empower you with regard to the answer of interpretative questions in mapwork. Remember that a large amount of information could be found on the topographical and orthophoto map. To answer these questions successfully, you must know what to consider getting to the answer. Most of these questions come from previous matric examination question papers. Other possible questions have also been included. Remember that it is by no means a memorandum that accompanies the questions, but an attempt **to show you what to consider getting to the answer**. You must realize that **ALL** content, modules and skills can be assessed in mapwork. Therefore use this guide to study and prepare yourself for your mapwork question paper.

(The material in this section is adapted from Telematics project that stems from the cooperation between the Western Cape Education Department and Stellenbosch University.)

Examination Guidelines for Mapwork (Paper 2)

1. This is a one and a half hour paper and will be written in the second session on the day of the Geography examination.
2. This question paper consists of four questions that are compulsory and is comprised of the following:

   Question 1: Multiple choice – 10x2 = (20)

   Question 2: Geographical techniques and calculations – 20 single marks

   Question 3: Application of theory / map and photo interpretation – 20x2 = (40)

   Question 4: Geographical Information Systems – 10x2 = (20)

GEOGRAPHIC SKILLS AND TECHNIQUES

1. Mapwork techniques

- Contour lines, contour interval and height
- Conventional signs
- Compass direction
- True / geographic bearing
- Map scale
- Calculating distance in reality - straight line and winding
- Calculating area
- Map reference numbers / map index

- Map coordinates / fixing position
- Alphanumeric reference / grid reference
- Magnetic bearing
- Calculating gradient
- Cross-sections
- Vertical exaggeration
- Intervisibility
- Orientation of orthophoto map to topographic map

2. Application

- Interpretation of 1:50 000 topographic maps
  - Interpreting physical features e.g. relief, drainage, climate and vegetation
  - Interpreting cultural features e.g. settlement, land-use and transport networks
- Application of all aspects of syllabus covered in the theoretical section of Geography

3. Photographs used in mapwork

- Types of photographs
- Advantages and disadvantages of different types of photographs
- Orthophoto maps
- Size, shape, tone, texture, shadow and patterns of photographs
- Compare orthophoto maps to topographic maps
- All techniques mentioned under mapwork techniques applicable to orthophoto maps

4. Application

- Interpretation of 1: 10 000 orthophoto maps
  - Interpreting physical features e.g. relief, drainage, climate and vegetation
  - Interpreting cultural features e.g. settlement, land-use and transport networks

- Application of all aspects of syllabus covered in the theoretical section of Geography

5. Map Projections

- Types of map projections / concepts
  - Mercator
  - Gauss Conformal
  - Universal Transverse
  - Lambert
- Properties of map projection
  - Scale
  - Size
  - Shape
  - Distance
  - Direction
  - Area

6. Geographical Information Systems

- Concepts of
  - GIS
  - Remote sensing
  - Resolution
  - Spatial and attribute data
  - Vector and raster data
  - Spatial objects
    (points / nodes, lines, area / polygons, pixels)
- Components of GIS
- Sources of information for GIS
- Concept of layering of information
- Data manipulation and analysis
  - Concept of data manipulation
  - Data integration
  - Buffering
  - Querying
  - Statistical analysis
- Application of GIS by the
  - government

- private sector

CLIMATE AND WEATHER

1 Does the area receive seasonal rainfall or rainfall throughout the year?

Seasonal: Non perennial rivers/ dams/ cultivated lands near rivers/ irrigation

2 Which slope is the warmest?

The northward facing slope.

3 Where would you find temperature inversions?

In valleys

4 In which direction will the smoke blow if a fire is made in the evening on the middle slopes?

NB KATABATIC flow is examined. The smoke will move DOWNWARDS towards the valley. (The opposite for anabatic flow)

5 In which direction will a airplane take off and land before/after a cold front.

(Remember that airplanes always land and take off against the wind.)

Before front: Takes off and lands in NW direction. After front: takes off and lands in SW direction

6 Which residential areas will be influenced by pollution the most during winter / day / night?

Look at NW and SW winds as well as the direction of land and sea breezes

FLUVIAL PROCESSES (GEOMORPHOLOGY)

1 Identify the stream patterns in the area.

Types: Dendritic, radial, rectangular, trellis

– **You must know what each one looks like; and**

– be able to identify the underlying rock structures

2 In which stage of the fluvial cycle is the river on the map?

- Upper course: Steep/ mountainous/ waterfalls/ short tributaries/ high watersheds
- Middle course: Gradual slope/ longer tributaries/ low watershed
- Lower course: Very gradual/ meanders/ sand deposits/ marshes/ oxbow lakes

3 Physical aspects influencing construction of railways and roads.

Mountains/ steep slope/ marshes/ rivers

4 Identify landforms regarding structural landscapes

Horizontal layers: Mesa/ butte/ conical hills/

Inclined layers (strata): Dip and scarp slopes

Massive igneous rocks: Dome shaped landforms (batholiths, laccoliths, lopolith, tors)

5 In which direction do the layers dip?

Layers always dip in the direction of the GRADUAL slope.

6 In which direction does the river flow?

- Towards the sea
- Always from high to low.
- Contours bend upstream
- Dam wall on downstream side
- Tributaries join at acute angles

7 Name two temporary bases of erosion in the river

Waterfall / dams / lakes

8 What indication is there that rejuvenation has occurred in the river?

Waterfall

ECOLOGY

1 Nature conservation on map/photo

Nature reserves/ Hiking trails/ Fire break/ wild reserve/

2 Indication of conservational farming

Anti erosion walls/ camps/ rows of trees to reduce wind/ contour ploughing/

3 Sources of pollution in area?

Air pollution: Industries

Noise pollution: Airport

Water pollution: Factories/ camping sites/ power station near river

PEOPLE AND THEIR NEEDS (ECONOMIC GEOGRAPHY)

(a) PRIMARY ACTIVITIES

1 Commercial vs Subsistence farming?

Commercial: Good infrastructure/ irrigation/ large farms/ farm names/ cellar/ dipping tank/experimental farm/ estate/ sugar mill/ service rail/ abattoir/ dairy

Subsistence: Few roads/ foot path/ no power lines / small patches of cultivated land

2 Describe factors influencing agriculture: Advantage & disadvantage

Advantage: Rivers/ dams/ flat land/ power lines/ railway lines/ telephone lines/

Disadvantage: Steep slopes/ water scarce/ marshes

3 Identifying of mining activities

Excavations/ mine dump/ conveyer belt/ terraces/ names of mines/ old mines/ subsiding ground

4 Identifying of fishing activities

Fishing harbours / Fisherman's houses/ factories near coast/

5 Identifying of forestry

Trees/ woodlands/ sawmill/ lookout towers/ fire break/ state forest/

(b) <u>SECONDARY ACTIVITIES</u>

1 Describe the factors influencing the location of the industries.

Flat area/ raw materials/ transport (name types)/ power supply/ water/ workforce (residential area) /market/ outskirts

2 Light or heavy industries?

Heavy: Far from CBD/ transport-rail/ Raw material-mining

Light: Near CBD/ transport-road/ raw material-agriculture

(c) <u>TERTIARY CTIVITIES</u>

1 Tourist attractions, holiday resorts, camping sites

Near beaches/ near roads & railway/ wine tasting/ historical buildings / monuments

2 Types of services in area

Electricity supply/ telephone/ medical/ post office/ educational (schools/ college/ university) /Police services/ etc. (Buildings on map)

3 Recreational facilities in area?

Example Golf course/ athletics/ shooting range/ Race track / Also look at names and functions on orthophoto map

4 Factors influencing location of airport/aerodrome

Flat land/ far from built-up area – safety/ noise/ roads/ urban rural fringe

5 Do the road and railway line follow the same route? Why?

The same? NB Topography

6 For what is the dam used on the map? Give reasons

- Drinking water: Purifying works
- Irrigation: Canals and furrows
- Recreation: Yacht club, hotels at dam, camping site, slipway etc

PEOPLE AND PLACES: SETTLEMENT GEOGRAPHY

(a) RURAL SETTLEMENT

1 Rural or urban (FUNCTION)

Rural: Primary functions

Urban: Secondary and Tertiary functions/ Mention examples on map and photo

2 Nucleated or dispersed (PATTERN)

Nucleated: Buildings near to each other

Dispersed: Buildings far

3 Factors influencing site of rural settlements

Rivers/ flat land/ fertile soil near rivers/

4 Factors influencing shape of settlements

- Linear : Road/River
- Round: central point
- Crossroad: Roads that cross or join

(b) <u>URBAN SETTLEMENT</u>

1 Describe the factors that influenced the site of the urban settlement on the map

Flat land/ roads/ river/ railway/ mountains/ sea etc.

2 Type of settlement based on function

Central place town: Does the settlement serve its surrounding rural area

(Sphere of influence)

Specialized settlement: Is it a mining town / holiday town/ educational town?

3 Identify the land-use zone at ..... on the map/ orthophoto

- CBD – Accessibility/ functions
- INDUSTRIES: Light or heavy/ influencing factors/ (see economic)
- RETAIL: In CBD/ isolated shops in residential areas/ shopping centres – main roads
- RESIDENTIAL AREAS: High income-slope/low income – near factories
- RURAL URBAN FRINGE. : Racing track/ power station/ cemetery/ golf course etc

4 Shape and factors determining shape

Linear: Mountains/ rivers

Stellar: Roads

5 Identify street patterns and factors

Rectangular: Flat land/ oldest

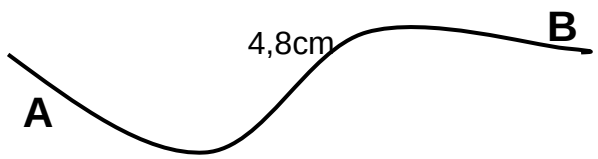
Irregular: Undulating surface / steep slope/ later development

C A L C U L A T I O N S

DISTANCE

FORMULA: Distance = $\frac{\text{Distance on Mapx Scale}}{100\ 000}$

Calculate the distance of the national road from A to B



STEP 1
Measure distance on the map in **cm**

Distance = 4,8cm

STEP 2
Place in Formula

$$\text{Distance} = \frac{\text{Mapdistance x Scale}}{100\ 000}$$

$$= \frac{4{,}8 \text{ x } 50\ 000}{100\ 000}$$

$$= \frac{4{,}8}{2}$$

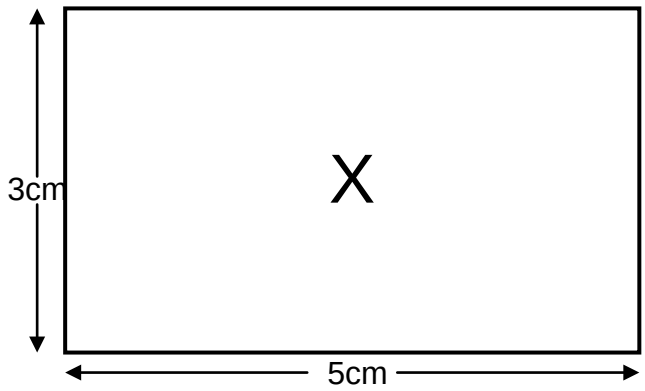
STEP 3
Answer in **km**

= 2,4 km

AREA

FORMULA: Area = Length x Breadth

Calculate the area of block X



STEP 1
Calculate length
(see distance)

Length = $\frac{5 \text{ cm} \times 50\,000}{100\,000}$

= 2,5 km

STEP 2
Calculate breadth
(See distance)

Breadth = $\frac{3 \text{ cm} \times 50\,000}{100\,000}$

= 1,5 km

STEP 3
Place in formula

Area = l x b
= 2,5 km x 1,5 km

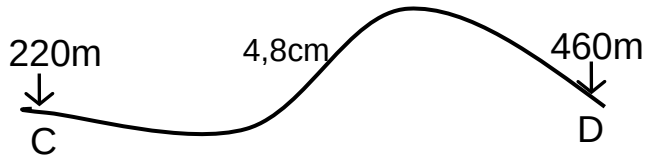
STEP 4
Answer in **km²**

= 3,75 km²

GRADIENT

FORMULA: Gradient = $\frac{\text{VI (Difference in height)}}{\text{HE (Distance)}}$

Calculate the gradient from C to D



STEP 1
Calculate difference in height **(VI)**

460 – 220 = 240m

STEP 2
Calculate distance **(HE)**

$$\text{Distance} = \frac{\text{Distance on Map}}{100\,000}$$

$$= \frac{4{,}8 \times 50\,000}{100\,000}$$

$$= 2{,}4 \text{ km}$$

STEP 3
Convert to **METER**

$$= 2\,400\text{m}$$

STEP 4
Put in formula and simplify

$$\text{Gradient} = \frac{\text{VI}}{\text{HE}}$$

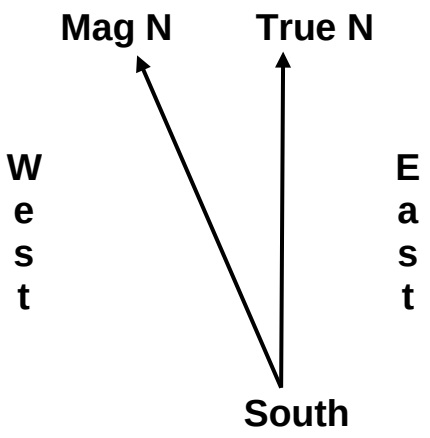
$$= \frac{240\text{m}}{2\,400\text{m}}$$

$$= \frac{1}{10}$$

$$= 1:10$$

MAGNETIC DECLINATION

Magnetic declination is the difference between true and magnetic north.



Consider the following when you work with magnetic declination:

1. What is the average mag declination (in degrees & minutes)?
2. In which direction is the magnetic declination?
3. In what year was the magnetic declination given?
4. What is the mean annual change (in minutes)?
5. In what direction was this change?
6. For what year must the magnetic declination be calculated?

Mean magnetic declination 23° 53' west of true north (July 2002).
Mean annual change 6' west.

Calculate the magnetic declination for 2009.

STEP 1
Calculate the difference in years

2009 – 2002
= 7 years

STEP 2
Calculate total change

6' x 7 years
= 42' west

STEP 3
Add to, or deduct from magnetic declination

23° 53' +
42'
23° 95'

STEP 3 NB: FOR SOUTH-AFRICA
If the change is towards the west, it is **ADDED**
If the change is towards the **EAST**, it should be **SUBTRACTED**

STEP 4
Remember: you are working with minutes. There cannot be more than **60**!

= 24° 35' west

T I P
Magnetic declination can be calculated easily if you **DRAW** the information supplied. You will then get a mental image of the calculation