

GRADE 8

SOCIAL SCIENCE

STRAND 1

ENVIRONMENT AND RESOURCES

SUB-STRAND 1:	PHYSICAL ENVIRONMENT
SUB-STRAND 2:	INFLUENCES OF PHYSICAL ENVIRONMENT ON HUMAN SETTLEMENT PATTERNS
SUB-STRAND 3:	CHANGING THE PHYSICAL ENVIRONMENT
SUB-STRAND 4:	WORKING TO SUSTAIN THE PHYSICAL ENVIRONMENT
SUB-STRAND 5:	NATURAL HAZARDOUS EVENTS

ACKNOWLEDGEMENT

We acknowledge the contributions of all Secondary Teachers who in one way or another have helped to develop this Course.

Our profound gratitude goes to the former Principal of FODE, Mr. Demas Tongogo for leading FODE team towards this great achievement. Special thanks to the Staff of the English Department of FODE who played an active role in coordinating writing workshops, outsourcing lesson writing and editing processes, involving selected teachers of Central Province and NCD.

We also acknowledge the professional guidance provided by Curriculum and Development Assessment Division throughout the processes of writing, and the services given by member of the English Review and Academic Committees.

The development of this book was Co-funded by GoPNG and World Bank.

DIANA TEIT AKIS

PRINCIPAL

Published in 2017 by the Flexible, Open and Distance Education, Papua New Guinea

© Copyright 2017, Department of Education, Papua New Guinea.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means electronic, mechanical, photocopying, recording or otherwise without the prior permission of the publisher.

Printed by Flexible Open and Distance Education.

ISBN: 978-9980-87-542-6

National Library Service of Papua New Guinea

TABLE OF CONTENTS

Table of Contents	3
Secretary's Message	4
Course Introduction	5
Materials	6
Strand Introduction	7
Study Guide	8
 SUB-STRAND 1: Physical Environment	9
Sub-strand 1: Introduction	10
 Lesson 1: The Physical Environment.....	11
 Lesson 2: Mapping the World	16
 Lesson 3: Latitudes and Longitudes	26
 Lesson 4: Climatic Zones	31
 Lesson 5: Climatic Zone Distribution	41
 Lesson 6: Major Winds	47
 Lesson 7: Continents	51
 Lesson 8: Oceans and Rivers	60
 Lesson 9: Water Cycle	66
 Lesson 10: Islands and Mountains	70
 Lesson 11: Grasslands and Deserts	76
 Lesson 12: Forests	82
 ANSWERS TO PRACTICE EXERCISES 1 – 12	89
 SUB-STRAND 2: Influences of Physical Environment on Human Settlement Patterns	95
Sub-strand 2: Introduction	96
 Lesson 13: Human Environment	97
 Lesson 14: Human Settlement Patterns	102
 Lesson 15: Adapting to the Physical Environment	107
 Lesson 16: Settling the World	113
 Lesson 17: World Population	119
 Lesson 18: Population, Maps and Graphs	125
 Lesson 19: Urbanisation	132
 Lesson 20: Urbanisation: A Comparative Study	138
 ANSWERS TO PRACTICE EXERCISES 13 – 20	142
 SUB-STRAND 3: Changing the Physical Environment	145
Sub-strand 3: Introduction	146
 Lesson 21: Natural Resources	147
 Lesson 22: Distribution of Natural Resources	153
 Lesson 23: Addressing Environmental Issues	157
 ANSWERS TO PRACTICE EXERCISES 21 – 23	161
 SUB-STRAND 4: Working to sustain the Physical Environment	163
Sub-strand 4: Introduction	164
 Lesson 24: Renewable and Non-Renewable Resources	165
 Lesson 25: Renewable and Non-Renewable Energy Resources	169
 Lesson 26: Sustainable Use of Renewable Resources	176
 ANSWERS TO PRACTICE EXERCISES 24 – 26	181
 SUB-STRAND 5: Natural Hazardous Events	183
Sub-strand 5: Introduction	184
 Lesson 27: Natural Hazards	185
 Lesson 28: Ozone Depletion	191
 Lesson 29: Global Warming	195
 ANSWERS TO PRACTICE EXERCISES 27 – 29	199

SECRETARY'S MESSAGE

Achieving a better future by individual students and their families, communities or the nation as a whole, depends on the kind of curriculum and the way it is delivered.

This course is a part of the new Flexible, Open and Distance Education curriculum. The learning outcomes are student-centred and allows for them to be demonstrated and assessed.

It maintains the rationale, goals, aims and principles of the national curriculum and identifies the knowledge, skills, attitudes and values that students should achieve.

This is a provision by Flexible, Open and Distance Education as an alternative pathway of formal education.

The course promotes Papua New Guinea values and beliefs which are found in our Constitution, Government Policies and Reports. It is developed in line with the National Education Plan (2005 -2014) and addresses an increase in the number of school leavers affected by the lack of access into secondary and higher educational institutions.

Flexible, Open and Distance Education curriculum is guided by the Department of Education's Mission which is fivefold:

- To facilitate and promote the integral development of every individual
- To develop and encourage an education system satisfies the requirements of Papua New Guinea and its people
- To establish, preserve and improve standards of education throughout Papua New Guinea
- To make the benefits of such education available as widely as possible to all of the people
- To make the education accessible to the poor and physically, mentally and socially handicapped as well as to those who are educationally disadvantaged.

The college is enhanced to provide alternative and comparable pathways for students and adults to complete their education through a one system, many pathways and same outcomes.

It is our vision that Papua New Guineans' harness all appropriate and affordable technologies to pursue this program.

I commend all those teachers, curriculum writers, university lecturers and many others who have contributed in developing this course.



UKE KOMBRA, PhD

Secretary for Education

COURSE INTRODUCTION



Dear Student,

Welcome to the Grade 8 Social Science Course. This course is based on the Education Department's Outcome Based Upper Primary Social Science Syllabus. However, you will be doing this course by correspondence or at your own time at your home.

Before we look at what you will study in this course, you must remember what you studied in Grade 7 Social Science. The strands you studied in Grade 7 are the same as in Grade 8. However, Grade 7 has a national focus and Grade 8 an international focus.

The learning outcomes are student-centered and written in terms that enable them to be demonstrated, assessed or measured. The outcomes are written to show progression from one grade to another. In this case, from Grades 7 to 8. Therefore, some ideas, topics and concepts you will study in this course will be familiar.

In the Grade 8 Social Science Course, the learning outcomes are organised into three strands. However, apart from these strands, you have three projects that you will study.

- 1. ENVIRONMENT AND RESOURCES**
- 2. ORGANISATION**
- 3. CULTURE**
- 4. PROJECT 1: CASE STUDY OF CHINA**
- 5. PROJECT 2: CLIMATE CHANGE**
- 6. PROJECT 3: SKILLS**

Each strand is divided into sub-strands and each consists of Lessons, Summaries, Practice Exercises and Answers. At the end of each lesson, you are expected to do the practice exercise.

The answers to each practice exercise are found at the end of each sub-strand. You must correct your own answers. A test is given for each sub-strand in the Assignment Booklet.

There are three Assignments and three Project Assignments giving a total of six. You will find each assignment after each strand you study. You must do these assignments.

Before working on them, you must revise all the lessons. Remember to check all your assignments before you send them in for marking. The Assignment marks will be added together with your final external examination mark. This will give you a final mark and grade.

There will be an examination after you have completed this course. You will do the examination only after all your Assignments have been marked.

We hope you will find this course interesting and challenging.

All the best in your studies!

COURSE MATERIALS

Your course consists of two parts:

PART A:	STRAND 1	ASSIGNMENT 1
	STRAND 2	ASSIGNMENT 2
	STRAND 3	ASSIGNMENT 3

You must complete Part A before we send you Part B.

Part B materials are as follows:

PART B:	PROJECT 1	ASSIGNMENT 4
	PROJECT 2	ASSIGNMENT 5
	PROJECT 3	ASSIGNMENT 6

After the completion of these Strands, Projects and Assignments, an Examination notice will be sent to you. This notice will be communicated to you by your Provincial Coordinator in your Province.

STRAND 1 INTRODUCTION (ENVIRONMENT AND RESOURCES)



Welcome to Strand 1 of the Grade 8 Social Science Course. This Strand is about Environment and Resources.

In this Strand, you will:

- compare physical environments and describe the factors and processes that have formed them.
- look at how physical environments influence human settlement patterns.
- evaluate the impact of resource use on the world's physical environment and human settlement patterns.
- identify international examples of sustainable practices in the natural environment and propose possible solutions to problems.
- identify and describe the causes and effects of hazardous natural events in other parts of the world and how people respond to them.

The five Sub-strands you will study are:

1. Physical Environment.
2. Influences of Physical Environment on Human Settlement Patterns.
3. Changing the Physical Environment.
4. Working to sustain the Physical Environment.
5. Natural Hazardous Events.

In Sub-strand 1, **The Physical Environment**, you will learn about the features of the natural environment and the processes that have formed them.

In Sub-strand 2, **Influences of Physical Environment on Human Settlement Patterns**, you will learn about how the natural environment affect the way people live in different parts of the world.

Sub-strand 3 looks at **Changing the Physical Environment**. You will study how people change the natural environment to suit their living.

Sub-strand 4, **Working to Sustain the Physical Environment**, you will learn about the ways of looking after our resources for later use.

In sub-strand 5, **Natural Hazardous Events**, you will study the natural disasters which cause destruction to both the physical and human environment.

Each Sub-strand has **Lessons** with **Practice Exercises** and **Answers**. You must read each lesson and work through the Practice Exercises. You will have to correct your own answers. The answers to the Practice Exercises are given at the end of each Sub-strand.

When you complete a Sub-strand, you will then complete the **Sub-strand Test** in the **Assignment Booklet**. You will repeat the same process until you complete the Strand.

ALL THE BEST

STUDY GUIDE

Follow the steps given below and work through the lessons.

- Step 1:** Start with Sub-strand 1, Lesson 1 and work through it in order.
- Step 2:** When you complete Lesson 1, you must do Practice Exercise 1.
- Step 3:** After you have completed the exercise, you must correct your work. The answers are given at the end of each Sub-strand.
- Step 4:** Then, revise well and correct your mistakes, if any.
- Step 5:** When you have completed all these steps, tick the check-box for Lesson 1, on the content page, like this:



Lesson 1: What is Government?

This will help you, check your progress.

Then go on to the next lesson. You are to repeat the same procedure until you complete all the lessons in a Sub-strand.

Assignment: Sub-strand Test and Strand Test

When you have completed all the lessons in a Sub-strand, do the Sub-strand Test for that Sub-strand, in your Assignment Booklet. The Strand book tells you when to do this.

Marking:

The Sub-strand Tests in each **Assignment** will be marked by your **Distance Teacher**. The marks you score in each Assignment will count towards the final result. If you score less than 50%, you will have to repeat that Assignment.

Remember, if you score less than 50% in three (3) Assignments, your enrolment will be cancelled. So, you are encouraged to do your work carefully and make sure that you pass all Assignments.

Here is a sample Study Timetable to use as a guide. Refer to it as a reminder of your study times. A timetable will help you to remember when you should be doing some of your FODE work each day

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8:00 – 10:00	FODE STUDY TIME				
10:00 – 11:00					
1:00 – 2:00					
2:00 – 4:00					
6:00 – 7:00					
7:00 – 9:00	Listen to or watch current affairs programs. Write your diary, read a book.				

SUB-STRAND 1

PHYSICAL ENVIRONMENT

In this sub-strand you will learn about:

- **The Physical environment**
- **Mapping the world**
- **Latitudes and Longitudes**
- **Climatic Zones**
- **Climatic Zone Distribution**
- **Major Winds**
- **Continents**
- **Oceans and Rivers**
- **Water Cycle**
- **Islands and Mountains**
- **Grasslands and Deserts**
- **Forests**

SUB-STRAND 1 INTRODUCTION (PHYSICAL ENVIRONMENT)

In this Sub-strand you will learn about the physical environment and its key features.

Physical Environment refers to the **natural environment**. Environment is everything that is around us. Natural or physical environment are things around us which were not made by men but were in existence naturally.

For example, rivers and oceans, plants and animals, mountains and valleys, the air and sun light. All these are part of the natural or physical environment.

They are further classified into two groups; living things and non-living things as you have learnt in your Grade 7 Social Science Course, Strand 1.

Living things include plants and animals and non-living things refer to air and sunlight.

For many years, the earth has gone through processes to form the different features of the natural or physical environment such as the mountains and valleys, islands and etc.

The climate has also influenced the type of vegetation you find in a particular place. That is; the vegetation depends on the type of climate.

For example, places around the equator are hot and wet; therefore, they have a lot of tropical rainforest. However, as you go further away from the equator into the poles, it becomes colder and there is hardly any thick vegetation.

Sometimes these natural features are shown on maps. Maps are pictures of the earth's surface. In this sub-strand, you will be learning some skills to help you read and understand maps correctly.

Lesson 1: The Physical Environment



Welcome to Lesson 1 of sub-strand 1. This is the first Sub-strand of Grade 8 Strand 1 Course. In Grade 7 you learnt about the Physical Environment and further described physical features of earth. In this lesson, we will examine the earth and describe how the features of the natural



Your Aims:

- describe the physical world and the planet earth.
 - revise the key features of the physical environment.
 - define biosphere.
 - define the key features of the global physical environment.
-

What are the features of the physical environment?

The features of the physical environment are natural things found in different zones of this earth. The features in each zone together make up the zone that accommodates all living things. This zone is known as **Biosphere**.



I do not know what these zones are. Besides, I do not even know what they are made of too.

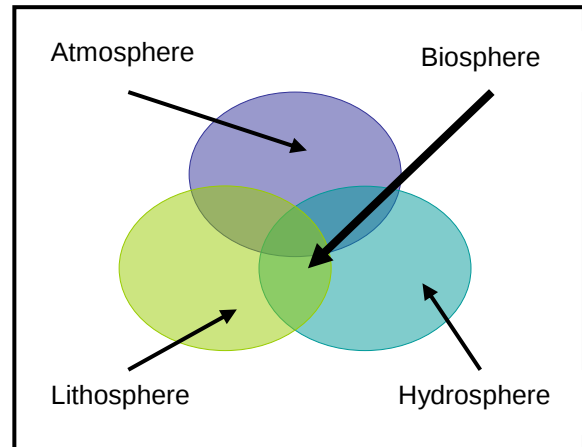
The physical world is divided into two broad divisions. They are the **living world** known as the **Biotic Environment** and the **Non-living world** known as the **Abiotic Environment**. While the biotic environment includes the Biosphere, the abiotic environment can be further divided into three (3) major spheres. They include;

1. Atmosphere – the gaseous envelope that surrounds the earth.
2. Hydrosphere – the water of the earth including the oceans, seas, lakes, glaciers and ice caps.
3. Lithosphere – the solid rocky crust of the earth and the upper mantle.

In brief we can say;

Atmosphere is the zone of air above the earth.
 Hydrosphere is the zone of water
 Lithosphere is the zone of rock/land
 Biosphere is the zone of life

Biosphere is made up of parts of the atmosphere, parts of the hydrosphere and parts of the lithosphere which is inhabited by the living organisms (plants and animals).



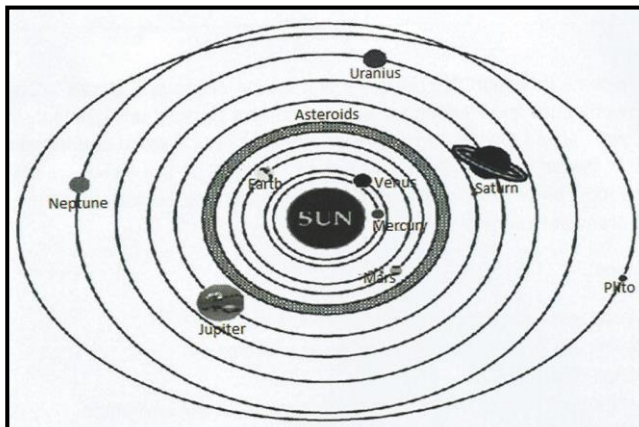
These divisions interact with each other to sustain life on earth.

Position of the sun and its effect on the biotic environment

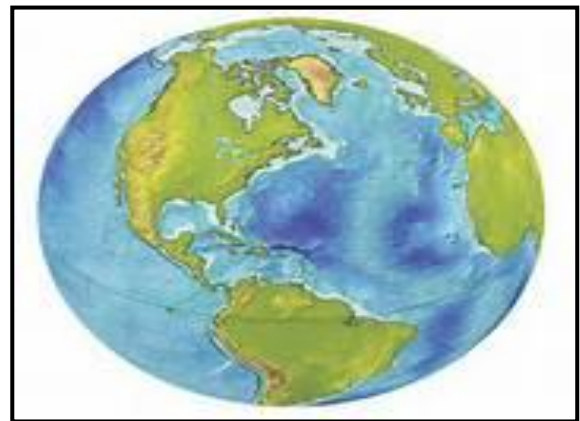
There are nine planets and many other objects that orbit the sun. The earth is 150 million kilometers away from the sun. The sun's energy is important to all living things on earth. The earth's position in space in relation to the sun affects the biotic environment. The earth is a **sphere** (a globe). It is a large body of material that orbits (goes around) the sun.

The earth is the right distance from the sun to support life. It is neither too close nor too far from the sun. If we were closer to the sun, the heat would boil and evaporate all the water above and below the earth as on planet mercury. Planets that are too far from the sun are too cold. The distance of the earth from the sun is just right and therefore the temperatures are also just right for all living creatures on earth.

Below is a diagram of the solar system and the earth.



The Solar System



The Earth

The earth sits at a slight/sloping angle creating different seasons in all parts of the world. It rotates (goes around) on its axis every 24 hours as it travels around the sun.

This gives us day and night. We all know that the sun rises and sets. This is actually the earth rotating towards the east.

The importance and inter-relationships between land, water and the atmosphere

The atmosphere protects us from the sun. It prevents the temperature from getting too hot or too cold. It gives us air to breath and affects our climate and weather. The atmosphere interacts with water and land, causing winds. Winds are very important in making climate zones. These winds carry cold and warm air many distances around the world. This affects the temperatures on the earth's surface to be high or low.

Many landforms such as mountains, hills and valleys have been formed by natural processes. They were formed as a result of either **external** or **internal** processes.

- (i) Internal processes like the movement of plate tectonics (movement of large land masses) and volcanoes occur under the earth's crust.
- (ii) External processes such as weathering, erosion and deposition occur on the surface of the earth.

These processes can either destroy or build landforms.

The movements of plates are responsible for the formation of physical features such as mountains, valleys, trenches, volcanic islands and many more. These landforms are then worn down and reshaped through weathering, erosion and deposition.



Summary

You have now come to the end of Lesson 1. In this lesson you learnt that:

- the features of the physical environment are natural things found in the different zones of this earth.
- the physical world is divided into two broad divisions. they are the **living world** known as the **biotic environment** and the **non-living world** known as the **abiotic environment**.
- the biotic environment is the biosphere which is known as the zone of life.
- the abiotic environment is further divided into 3 zones. They are;
 1. atmosphere – zone of air
 2. hydrosphere – zone of water
 3. lithosphere – zone of rock/land
- biosphere is made up of parts of the atmosphere, hydrosphere and lithosphere which is inhabited by the living organisms (plants and animals).
- all the physical features of the environment interact with each other to sustain life on earth.
- the earth's position in space also plays an important part in the biotic environment.
- many of the landforms we have today have been formed through geographical processes.
- the movements of plates are responsible for the formation of physical features such as mountains, valleys, trenches, volcanic islands and many more.
- these landforms are then worn down and re-shaped through weathering, erosion and deposition.
- the atmosphere protects us from the sun. It prevents the temperature from getting too hot or too cold.

NOW DO PRACTICE EXERCISE 1 ON THE NEXT PAGE
--



Practice Exercise 1

1. What are the features of the physical or natural environment?

2. What are the two broad divisions of the physical world?

- (i) _____
(ii) _____

3. Name the zone where all life exists?

4. The abiotic environment is divided into three zones. What are they?

- (i) _____
(ii) _____
(iii) _____

5. Name the features of the physical environment that work together to regulate the climate?

6. Which geographical processes are responsible for the formation of ocean trenches and ridges?

7. Name the processes that are involved in reshaping the earth?

CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 1
--

Lesson 2: Mapping the World



Welcome to Lesson 2 of sub-strand 1. In this lesson, you will learn about how the world we live on was mapped. You will study the importance of maps and its features and some very important lines on maps.



Your Aims:

- define map.
 - identify features of a map.
 - state the important lines of longitudes and latitudes.
 - discuss time differences.
-

What is a map?

A map is a diagram of an area showing physical features, cities and roads. It is a view of an area from above. Maps are geographer's special tools. A geographer uses lines, colours and symbols on maps to clearly show many pieces of information.

Early explorers and traders needed maps. Kings and Emperors wanted maps to show the extent of their lands. Today maps are needed for travel, towns and county planning, weather studies and many other reasons.

The very first maps were scratched on clay tablets or drawn on animal skins. The early maps were drawn on flat surfaces because people thought the earth was flat with sides and corners.

However, the earth is shaped like a sphere (ball). Therefore, the most accurate way to represent it is with a globe. Even when globes were made, people still wanted flat maps. That is why maps can also be drawn using large scale and rolled up or folded for carrying or bounded into a book to make an **atlas**. An atlas is a book of maps or charts.

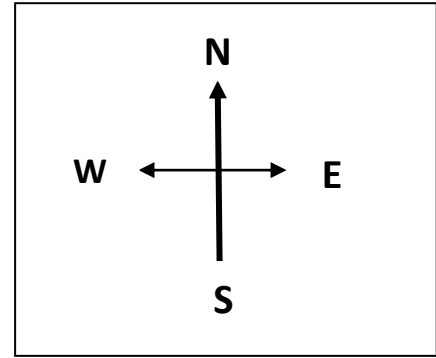
Features of a Map

There are three important features of a map.

- (i) Orientation
- (ii) Scale
- (iii) Key (Legend)

(i) **Orientation** is the normal rule or understanding; that when you hold a map or look at a map in a book, north should always be at the top of the page. This is the same with a globe. It will have the North Pole at the top.

The cardinal points are **north, south, east** and **west**. We use these points with latitude and longitude to describe locations on earth.



(iii) **Scale** is a ratio of size on a map.

Maps are always drawn to scale because they are much smaller than the area they show. A globe or the maps of the world in an atlas are small-scale maps.

They show a large area without much detail. A large-scale map shows a relatively small area in a lot of detail. The scale of the map you choose depends on what you want to use it for.

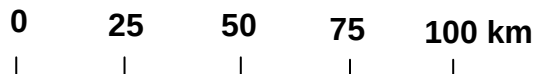
For a plan of your classroom you might choose a scale of 2 centimetres on paper to represent 1 metre on the ground.

For a map of your school you might use 1 centimetre on the map to represent 10 metres on the ground. A map of a town centre might have a scale of 1 centimetre to represent 250 metres, while a map of the whole of the Papua New Guinea might use 1 centimetre to represent 50 kilometres.

Below is an example of a scale that you will find on a map.

Scale: 1cm: 25km.

This means One centimeter on the map represents 25 kilometres on the ground.

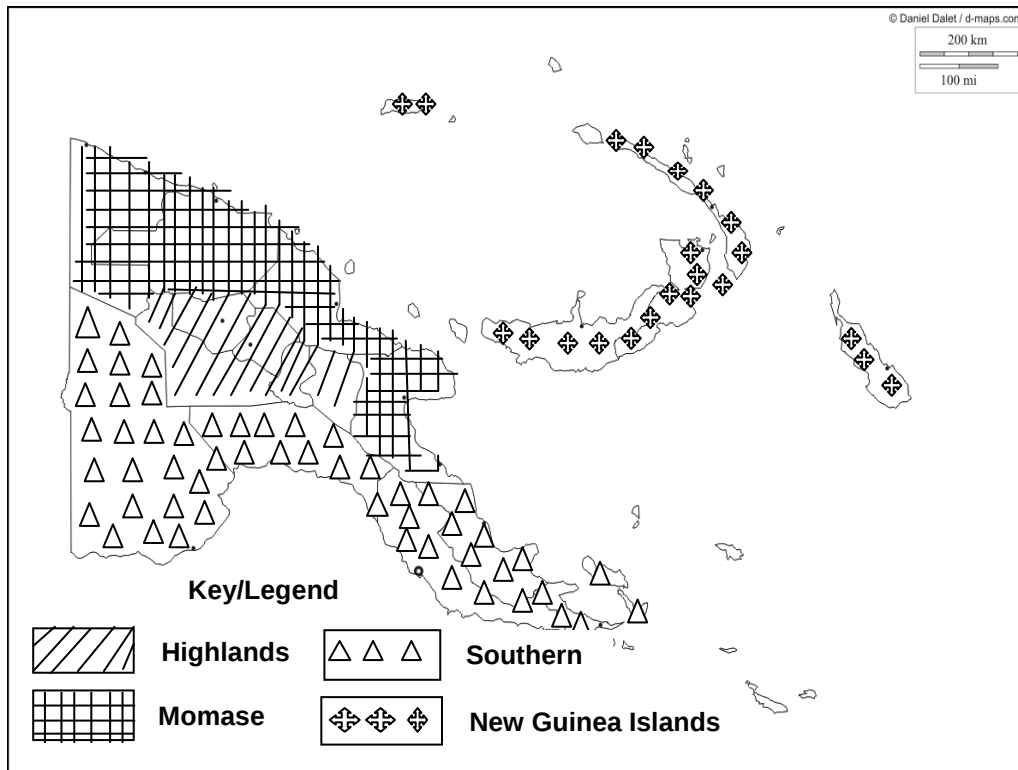


(iii) **Key (Legend)** tells you what all the different symbols used in a map mean.

The key identifies physical features, such as forests, mountains, rivers and oceans. It can also give human features including political boundaries.

Below is an example of a map with a **key**

Papua New Guinea and Its Regions



Lines of Longitude and Latitude

We can use a **grid** to locate any place on the earth's surface. A grid is a series of lines that run parallel and perpendicular to each other. When we put a grid on a sphere, we have two different sets of lines. These are the lines of **latitude** and **longitude**.

Lines of Latitude run from east to west. They run parallel to the equator and each other. Latitudes start at the equator at zero degree. They become shorter in distance as they move further away from the equator.

Important Lines of Latitude

A line of latitude tells us how far a place is north or south of the equator. But places on continents (as far apart as South America and Africa), can still be on the same line of latitude.

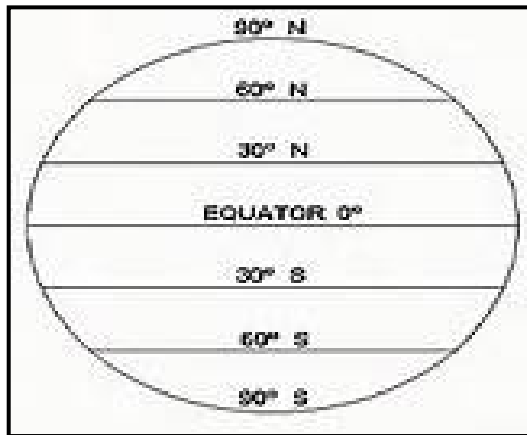
The most significant imaginary lines running across the surface of the earth are the;

- i) Equator
- ii) Tropic of Cancer
- iii) Tropic of Capricorn
- iv) Antarctic Circle
- v) Arctic Circle

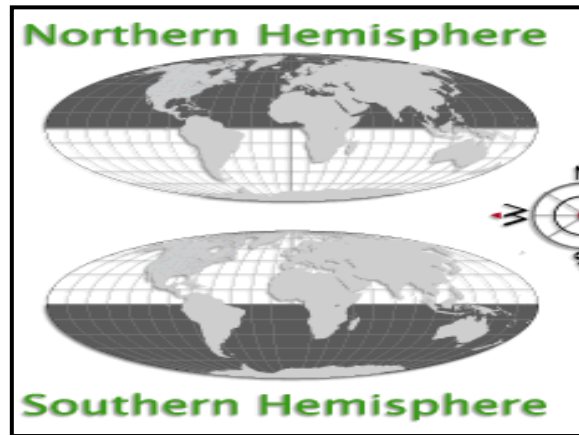
- The **equator** is an imaginary line around the earth at equal distances from the poles. It runs right around the earth at zero (0) degrees. It is the longest and a very important line which divides the earth into two identical or similar halves, called **hemispheres**.

The northern half of the equator is called the northern hemisphere and the southern half is known as the southern hemisphere.

Every place, unless it is exactly on the equator, must be either in the northern hemisphere or the southern hemisphere.



The Equator

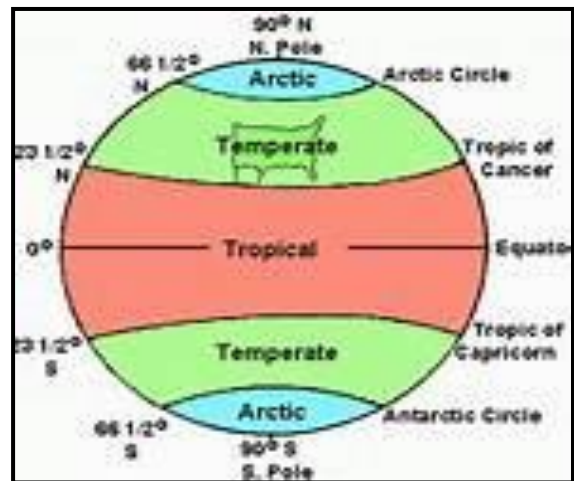
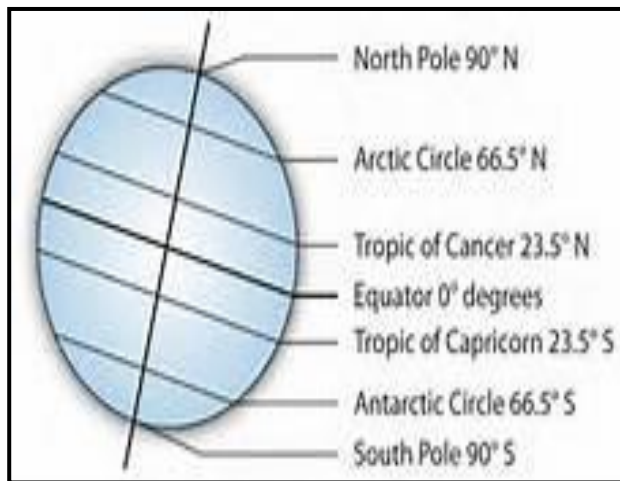


Northern and Southern Hemisphere

On the equator, the sun is directly overhead at noon and the length of day and night is equal every day of the year.

Day is always twelve (12) hours long and night is always twelve (12) hours long.

- The **Tropic of Cancer** is 23.5 degrees north of the equator. This means it is located in between the equator which is at zero degree and 30 degrees latitude north. The sun is directly overhead at noon on the Tropic of Cancer on the 21st of June. At this time the northern hemisphere experiences summer; while it is winter in the southern hemisphere.
- The **Tropic of Capricorn** is 23.5 degrees south of the equator. This means it is located in between the equator which is at zero degrees and the 30 degrees latitude south. The sun is directly overhead at noon on the Tropic of Capricorn on the 21st of December. At this time the northern hemisphere experiences winter while; it is summer in the southern hemisphere.
- **Antarctic Circle** is one of the five major lines of latitudes that mark maps on earth. It is about 66 degrees south of the equator.
- **Arctic Circle** is the line of latitude to the north of the equator about 66 degrees.



Lines of latitude are important in their relationship between the earth and the sun

Lines of Longitude run from the North Pole to the South Pole. Longitudes start at the Prime Meridian at zero degree. A longitude tells us how far east or west a place is from the Prime Meridian.

Important Lines of Longitude

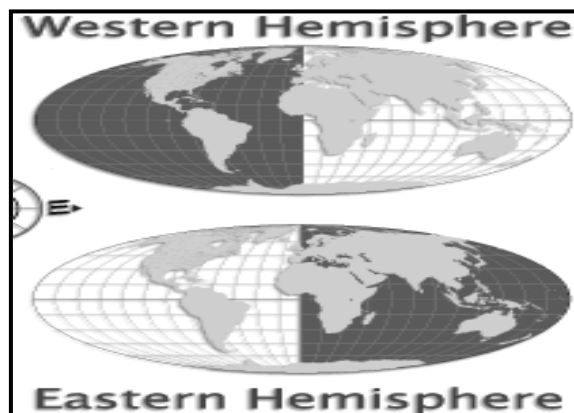
As stated above, longitudes are lines which run up and down from the North Pole to the South Pole. There are two very important imaginary lines running down from the North Pole to the South Pole.

- i) The Prime Meridian/Greenwich
- ii) The International Dateline

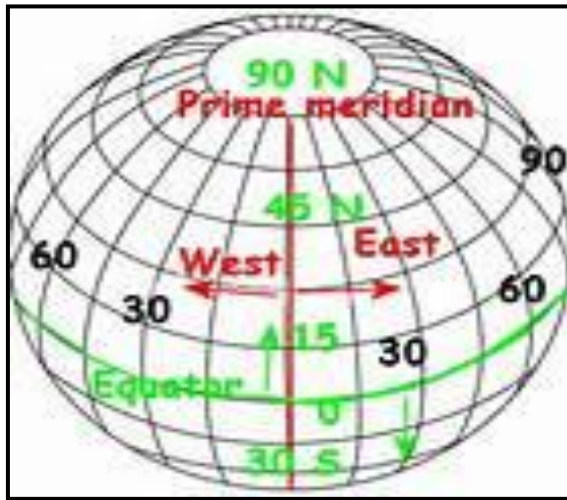
- The **Prime Meridian or the Greenwich meridian** is a zero degree line which divides the earth into the eastern and the western hemispheres.

Generally, the **Western Hemisphere** includes about half of Antarctica and all of North and South America which includes the Caribbean and Central America as well as Greenland.

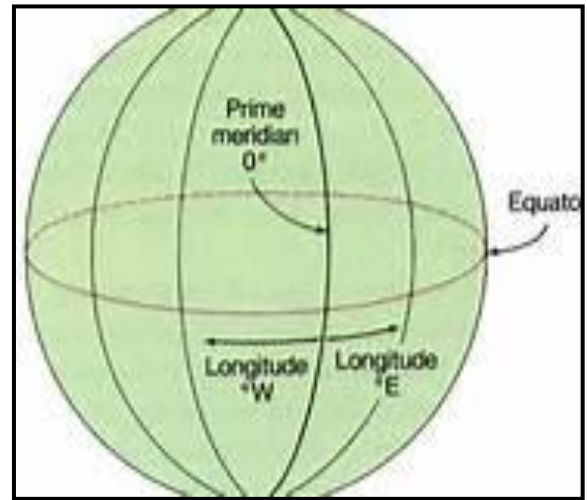
The **Eastern Hemisphere** includes most of Africa, about half of Antarctica, all of Asia and Australia or Oceania, and most of Europe.



Greenwich meridian is a fixed point from which longitudes are measured. In 1884, the international conference which established the modern system of time zones also agreed to use Greenwich as the prime meridian for all maps and hence **all timekeeping** throughout the world. See the diagrams on the next page showing the Prime Meridian.



Prime Meridian

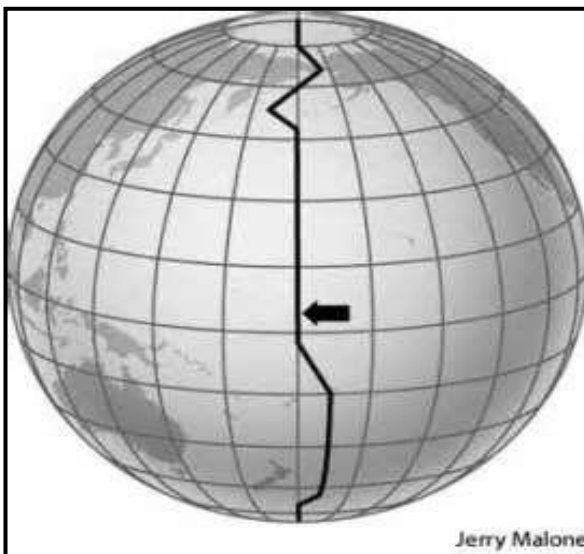


Prime Meridian

- The **International Dateline** is the line of longitude directly opposite the Prime Meridian. It is about 180 degrees from the Prime Meridian. It runs from the North Pole to the South Pole. It passes through the middle of the Pacific Ocean, roughly following the 180° longitude.

The International Date Line does not follow the 180° meridian along its entire course. It bends eastward around the eastern tip of Siberia, westward around the Aleutian Islands, and eastward again around various island groups in the South Pacific in order to avoid a time change in populated areas.

The International Dateline

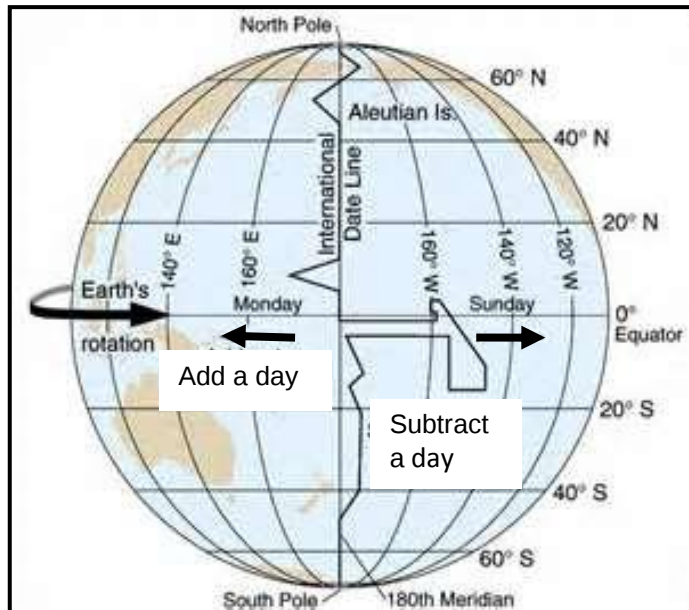


Lines of longitudes do not have any significance in regard to the earth and its relationship with the sun.

Time Difference

The world is divided into 24 hours time zones. Thus, the 180° line of longitude, exactly one-half way around the planet from Greenwich, England and 0° longitude is approximately where the International Date Line passes through.

The International Date Line was established at the International Meridian Conference in 1884 in order to standardise time, especially for the purpose of travel.



If you cross the line from the east to the west, a day is added.

If you cross the line from the west to the east, a day is subtracted.

Have a look at these time differences:

Here is how the International Date Line works. Let's say, you fly **from the United States to Japan**. We suppose you leave the United States on Tuesday morning. The time advances once you cross the International Date Line, it's suddenly Wednesday.

On the reverse trip home you fly **from Japan to the United States**. You leave Japan on Monday morning but as you cross the Pacific Ocean, the day gets later quickly as you cross time zones in an air plane. Therefore, once you cross the International Date Line, the day changes to Sunday.

Have a look at these time differences: It is amazing to learn that people in UK are still asleep when it is 11:00 o' clock in Papua New Guinea.

COUNTRY	TIME	DATE
Papua New Guinea	11:00 am	Wednesday 30 th October, 2013
United States	6:12 pm	Tuesday 29 th October, 2013
Mexico	7:15 pm	Tuesday 29 th October, 2013
El Salvador	7:15 pm	Tuesday 29 th October, 2013
United Kingdom	1:13 am	Wednesday 30 th October, 2013
South Africa	3:17 am	Wednesday 30 th October, 2013
Israel	3:15 am	Wednesday 30 th October, 2013



Summary

You have come to the end of lesson 2. In this lesson you have learnt that:

- a map is a diagram of an area showing physical features like, cities, roads rivers and oceans.
- the three important features of a map are; orientation, scale and the key.
- latitudes are imaginary lines which run from the east to west right around the earth.
- the equator, tropic of cancer, tropic of Capricorn, arctic circle and the Antarctic circle are all examples of latitudes.
- the equator runs at zero degrees dividing the earth into the northern and the southern hemispheres.
- longitudes are imaginary lines which run from the north to the south off the prime meridian.
- the prime meridian or the Greenwich meridian run at zero degrees, north to south dividing the earth into the eastern and the western hemispheres.
- the international dateline is the line of longitude directly opposite of the prime meridian. it is about 180 degrees from the prime meridian.
- as you cross the international dateline from the east to the west, a day is added on.
- as you cross the international dateline from the west to the east a day is subtracted.

NOW DO PRACTICE EXERCISE 2 ON THE NEXT PAGE
--

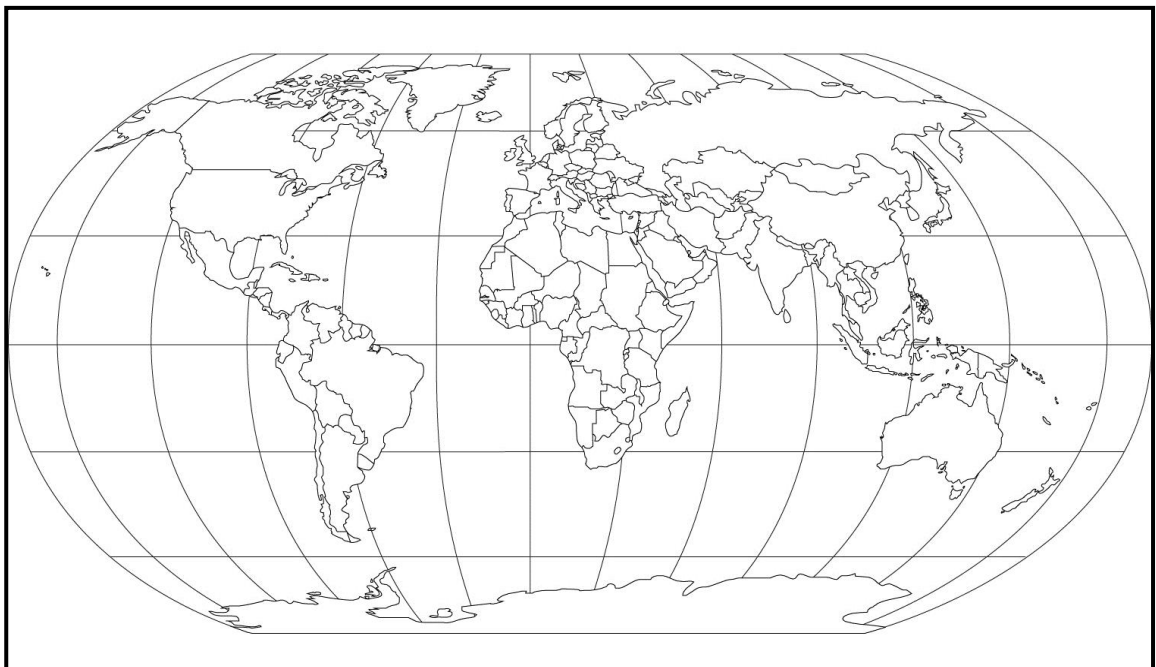


Practice Exercise 2

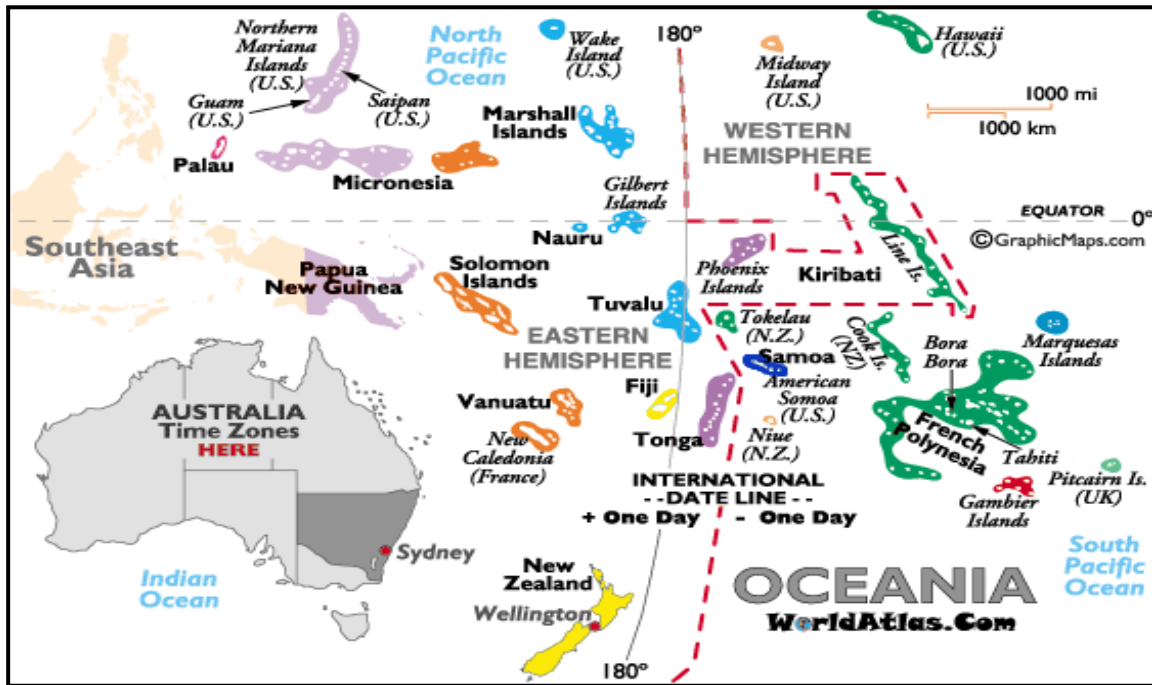
1. On this blank globe/map draw **only** the important lines of **latitude** and label them. Shade the northern and the southern hemispheres. Use different colours to make them clear.



2. Show the important lines of **longitudes** on this blank map. Label the eastern and western hemispheres.



2. Use the map of Oceania; and others in the lesson to answer questions.



- (i) When it is Monday in Australia, what day is it in Samoa?

- (ii) If you travel from Papua New Guinea on a Friday, to go to Marshal Islands. The moment you cross the international dateline it is _____.

- (iii) Imagine you are in American Samoa right now on this Wednesday. What day will it be, back in Papua New Guinea?

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 1

Lesson 3: Using Latitudes and Longitudes



Welcome to lesson 3. In the last lesson you learnt about mapping the world. In this lesson, you will find places on maps.



Your Aims:

- revise latitudes and longitudes.
 - find places on maps.
 - practice mapping skills.
 - identify places on maps using lines of longitude and latitude.
-

Start by asking yourself, “Where am I?” This question was asked before, and it led to the creation of a logical grid system of the world. A Greek geographer called *Ptolemy* developed this system by listing the coordinates for places throughout the known world. This system is written in degrees, using the symbol ($^{\circ}$). The location of any place on earth is described by two numbers, its **latitude** and **longitude**.

Latitude

If you look at a globe of the earth, the latitude lines run horizontally. Degrees latitude are numbered from 0° to 90° north and south. Zero degree is the equator, 90° north is the North Pole and 90° south is the South Pole. The lines of latitude are circles of different sizes.

Longitude

The vertical lines are called *longitude* and are known as *meridians*. Zero degrees longitude is located at Greenwich, England (0°).

It is called the Prime Meridian because it is the baseline from which all the other longitude measurements are made.

From 0° to the right or going clockwise around the globe to 180° is east of the Prime Meridian. From 0° to the left or going anti clockwise around the globe to the same 180° line is west of the Prime Meridian.

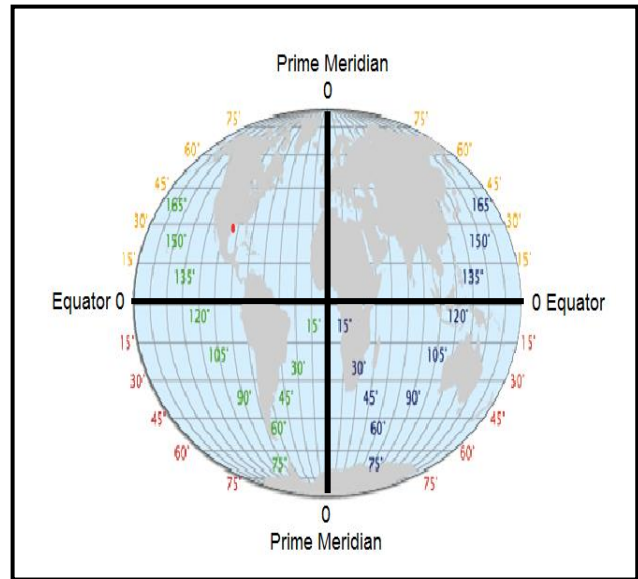
All lines of longitudes have the same length and meet at the North and the South poles. 180° longitude cuts through the Pacific Ocean and is known as the **International Date Line**.

How do Latitudes and Longitudes work together to determine the location of a place?

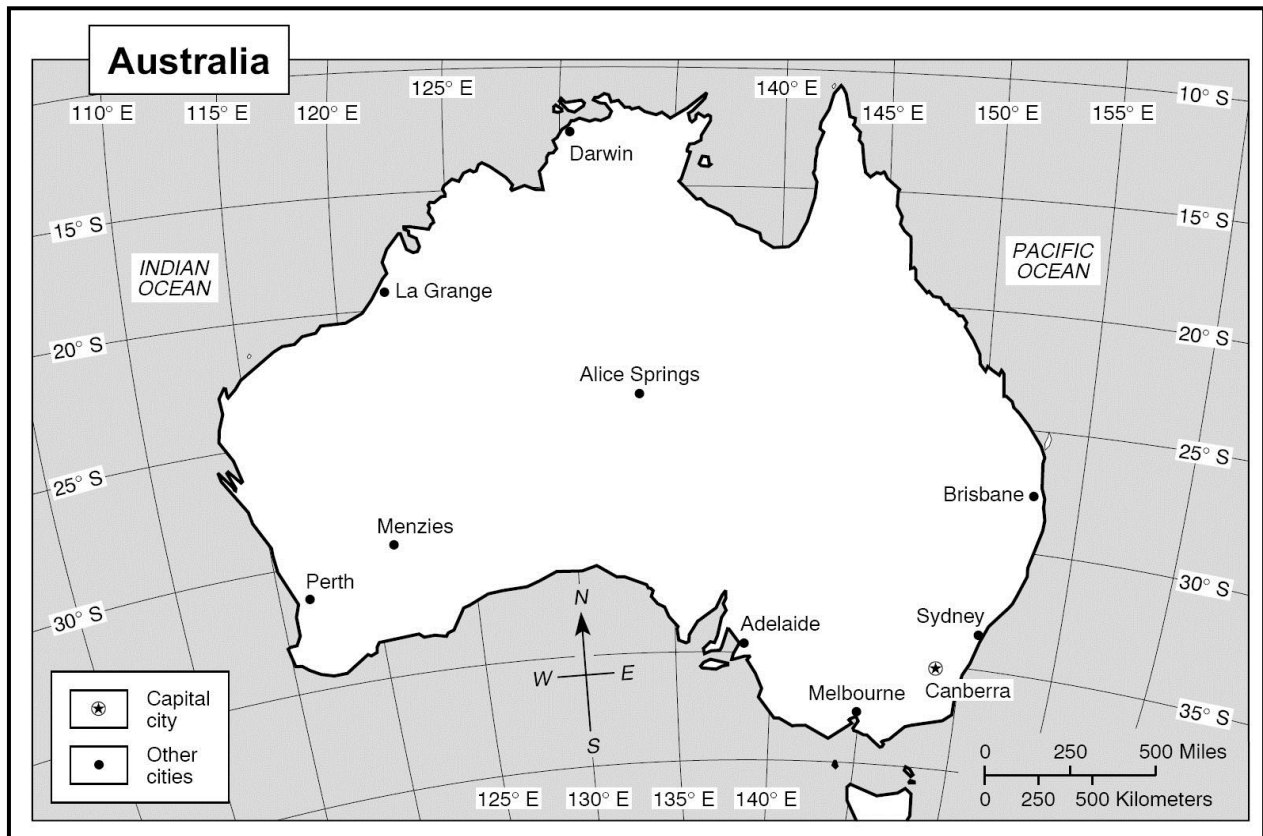
Remember that places are measured either north or south of the Equator and east or west of the Prime Meridian depending on which hemisphere they are located.

The lines of latitude and longitude when drawn on a map form a series of intersecting lines as shown on the diagram on the right.

The intersection of lines of latitude and lines of longitude can pin point any location on the surface of the earth. This can help locate or refer to places on maps.



To understand this, we will do a lot of exercises on locating places. Now, let us look at the map of Australia below. We are going to use longitudes and latitudes to find the location of Australia's towns and cities.



For example, we want to find the location of Adelaide on this map.

From lesson two, we now know that Australia is in the southern hemisphere and on the eastern side of the world. Therefore, our latitude will be towards the south and the longitude towards the east.

- Firstly, identify Adelaide on the map and put your pointer right on the dot.
- Move you pointer towards the east or west to see how many degrees is Adelaide to the south from the equator. You will see, it is 35 degrees south so write it down as 35°S.
- When you are done, go back to the dot. You will now find out how many degrees is Adelaide towards the east from the Prime Meridian. So now you move either up or down to see the degrees. When you do that, you will notice that Adelaide is about 140 degrees east so, write it down as 140°E.
- Finally, you have both coordinates so you can write them out. **Adelaide is 35°S, 140°E.**

Please take note, when the dots or places are not directly on the lines, give estimates only.

Always write the latitude first and then the longitude

With this experience, let us look at another example. Use the same map to find the latitudes and longitudes of these places;

- i) Darwin (13°S, 130°E)
- ii) Perth (32°S, 117°E)
- iii) Brisbane (28°S, 153°E)

Great work! If you have done this without looking at the answers then, good on you. You are now able to locate any place on maps.

On the other hand, you may be given the latitudes and longitudes to find a place. For instance, your answers will be;

- i) 37°S, 145°E. In this case, the place on this point is **Melbourne.**
- ii) 26°S, 137°E. **Alice Springs**

Other times you will be asked such questions as:

- Give the location for Melbourne or Alice Springs.
- What is the latitude and longitude for Melbourne or Alice Springs?

It is very important that you know how to find places on a map using latitudes and longitudes. You should know the four hemispheres of the earth learnt in lesson two so that you have a fair idea on the location of a place.



Summary

You have come to the end of lesson 3. In this lesson you have learnt that:

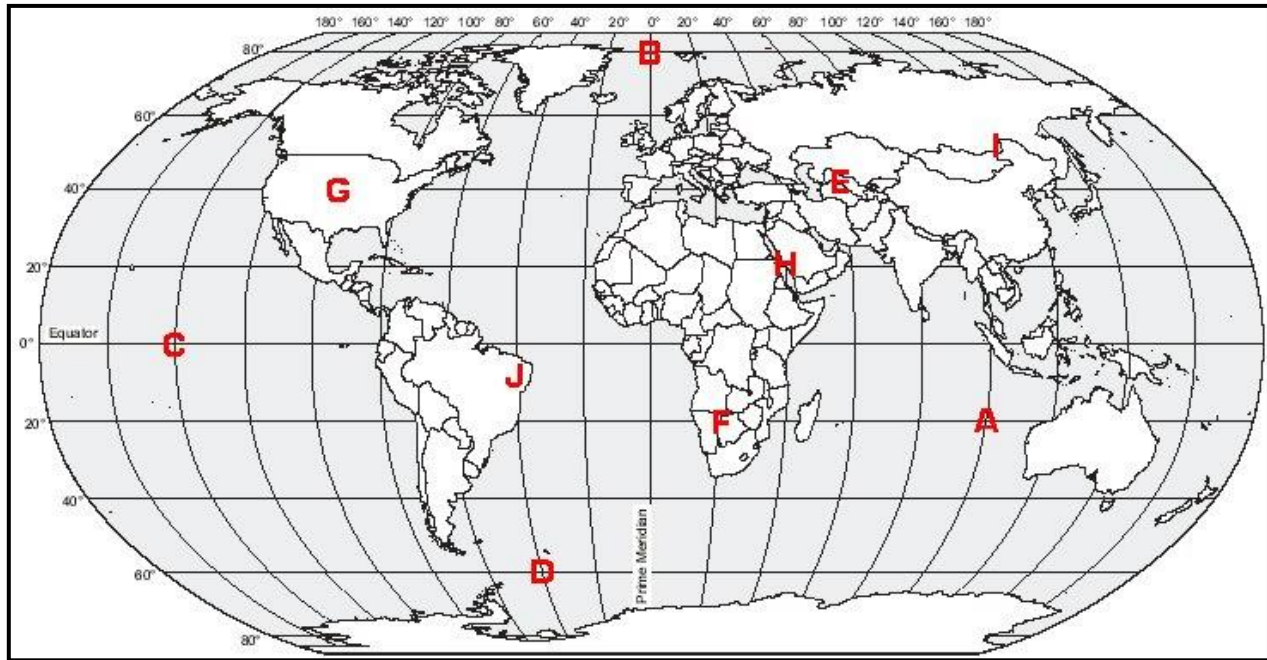
- all lines of latitudes and longitudes are measured in degrees north and south of the equator, east and west of the prime meridian.
- latitudes are measured in reference to the equator.
- longitudes are measured in reference to the prime meridian.
- prime meridian is the line which runs at zero degrees north to south dividing the earth into the eastern and the western hemisphere.
- equator is the major line of latitude that runs east to west separating the world (globe) into north and south.
- latitudes and longitudes on a map form a series of intersecting lines which pin point any location on the surface of the earth.
- when locating places, the latitude always comes before the longitude.
- when the given place is not right on the dot then, give estimates of latitudes and longitudes.

NOW DO PRACTICE EXERCISE 3 ON THE NEXT PAGE
--



Practice Exercise 3

Use the map below to answer Questions 1, 2 and 3.



1. Select the correct letter that matches the latitude and longitude coordinates given below.

- (i) 20° S, 20° E _____
- (ii) 20° S, 100° E _____
- (iii) 20° N, 40° E _____
- (iv) 60° S, 40° W _____

2. Which letter is located right on the Prime Meridian? What is the latitude of this letter?

3. Write the coordinates of these letters.

- (i) G: _____
- (ii) J: _____
- (iii) E: _____

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 1

Lesson 4: Climatic Zones



Welcome to lesson 4. In the last lesson you've learnt about finding the locations of places on maps. In lesson 4, we will learn about the different climates of the world and why these climates are different in various parts of the world.



Your Aims:

- define climate, climatic zone, season and monsoon
 - discuss why climate zones exist
 - identify the major climatic zones and their seasons
-

Before we go further into the lesson, let us define some very important words. These words will help you understand the content of the lesson. They will be used more often in the lesson.

What is Weather?

Weather is the day to day recording of the temperature, humidity, atmospheric pressure, wind and rainfall.

What is Climate?

Climate is the long- term (approx. 30 years) reading of temperature, humidity, atmospheric pressure, wind, rainfall of a particular place.

Climate is basically the "average weather," The difference is that weather is the condition of these elements right now for shorter period which are up to two weeks. Climate is about thirty years and over.

Let us find the meanings of the following words.

Temperature is the measurement of how hot or cold the atmosphere is. It is measured in degree Celsius.

Humidity is the amount of water vapour in the air. Water vapour is water in the form of gas which is in the air.

Atmosphere refers to the air which covers the earth from the sun's heat. It is comprised of gases with several layers to keep off the sun's heat.

Atmospheric Pressure refers to the pressure or the force caused by the weight of the atmosphere.

Wind is the moving air and it moves in any direction.

Rainfall is the droplets of liquid water from the atmosphere. Water vapour from the atmosphere changes into liquid and falls as rain when it becomes so heavy.

The World Climatic Zones

Climatic zones are divisions of the earth's climates according to average temperature and rainfall.

We have three main climatic zones of the world.

- i) Tropical Zone
- ii) Temperate Zone
- iii) Polar zone

The **tropical zone** starts at the equator. Here the climate is generally hot and wet all year round. This is because the sun's rays shine directly at the equator at a shorter distance. The heat is greater at the equator. It is also wet because the equator runs through the oceans where the winds pick up a lot of moisture and drop them on the areas located on the equator. Therefore, there is a lot of rain in the tropics.

Between the two tropics and the two arctic circles is the **temperate zone**. This zone has four seasons in a year.

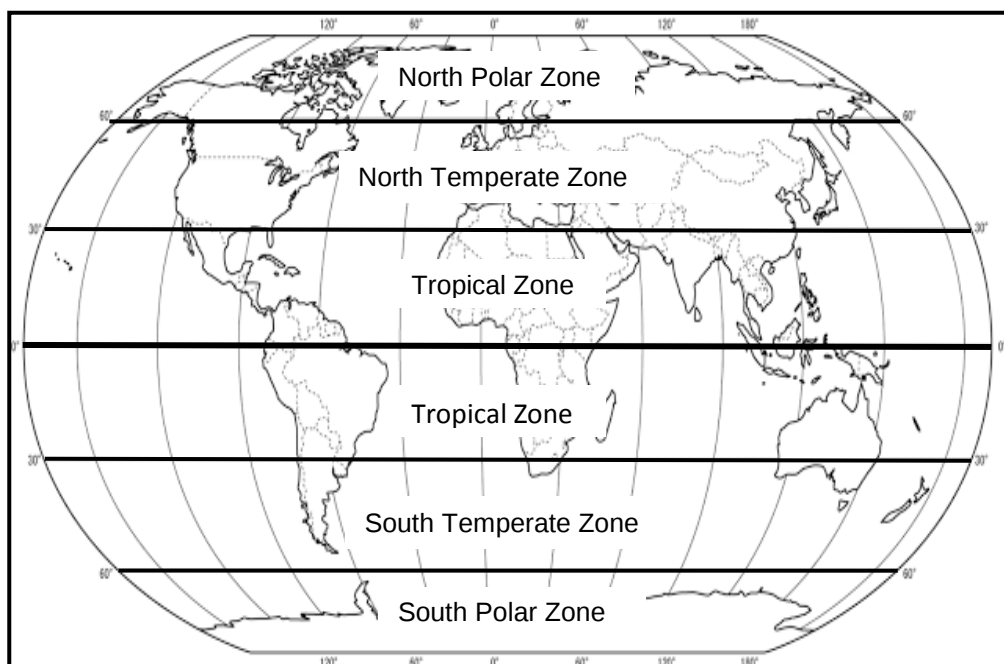
They are **summer, autumn, winter** and **spring**. Summer is the warmest season of the year between spring and autumn (fall). Autumn or fall is the season between summer and winter when leaves change colour and the weather becomes colder. Winter is the coldest season of the year between autumn and spring. Finally, spring season is between winter and summer when plants begin to grow.

There are different seasons here because the earth is tilted and revolves around the sun. When the earth tilts towards the sun, the summer season comes on. When it tilts away from the sun, winter season comes on.

The **polar zones** are the coldest. This region is covered in snow and ice most of the year round. The Polar Regions are far away from the sun's rays. The heat is not strong so it is very cold. They produce dry winds that blow from the poles.

Temperatures in these climate zones are determined mainly by the location or latitude of the zone.

World's Climatic Zones



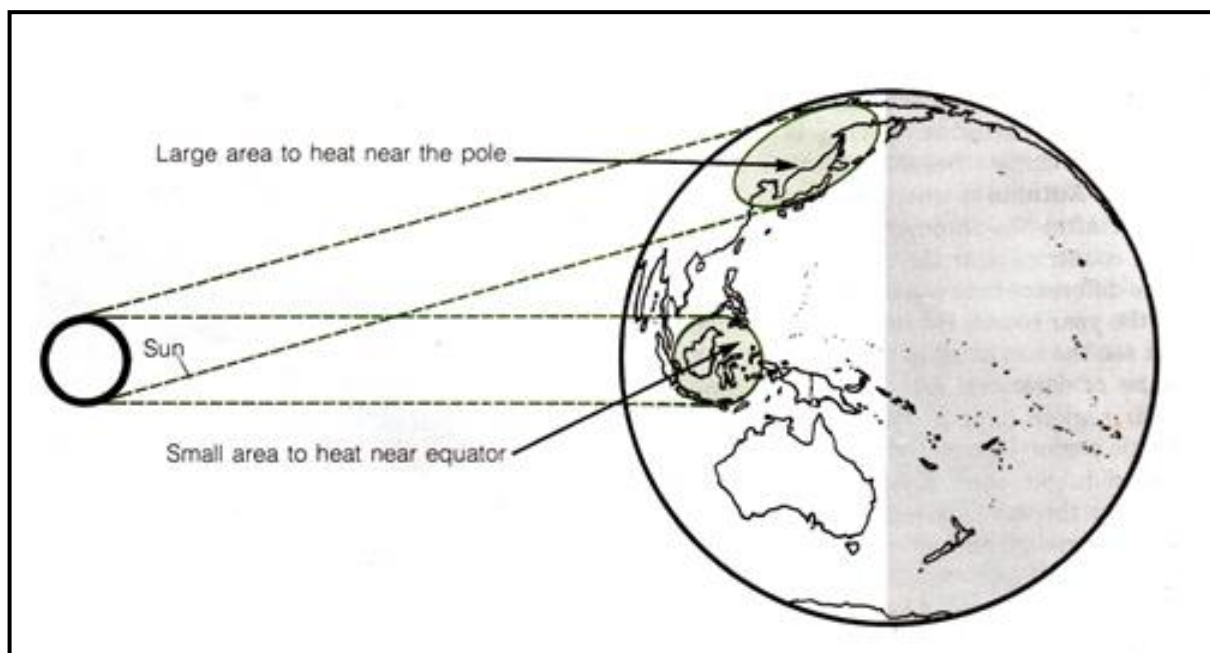
Why do we have different climatic zones?

There are factors which contribute to having different climatic zones. Below are some of them and they are; The Angle of the Sun, Rotation of the Earth, Altitude, Air movement, precipitation and Monsoon Winds.

i) The angle of the sun

As you move away from the equator, towards the poles, the average temperature decreases. This is because the angle of the sun is different in the tropics than at the poles. The heat of the sun spreads out covering larger land surface as you move away from the equator.

In the tropics, the sun reaches its highest point in the sky at midday. Whereas, in the polar region, the sun appears just above the horizon at midday.

Effect of the Angle of the Sun on the Temperature

As you can see from the diagram, the same amount of sunlight heats a smaller area around the equator, than the poles. This means the equator is much hotter than places near the poles.

Temperatures in these areas tend to be the hottest places on earth. Other locations, where the sun's rays hit at lesser angles, tend to be cooler.

In the poles, the sun is so low in the sky that very little heat is received, even at midday. That is why; the Polar Regions are permanently frozen.

ii) The rotation of the earth

The earth rotates around its own axis, and at the same time revolves around. But the axis around which the earth spins is not exactly vertical. It is tilted at an angle through the revolutionary path.

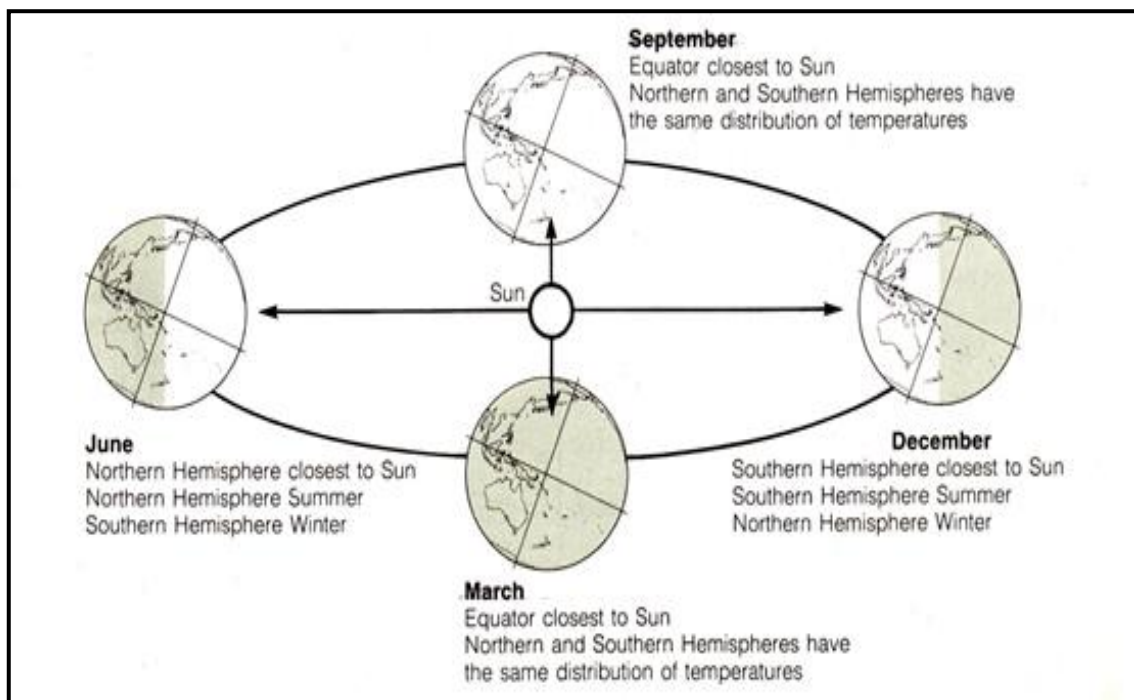
Axis is an imaginary line through the centre of an object, around which the object turns. The earth spins on its axis.

Revolves is to move around something in a circle. The earth moves around the sun.

So along the earth's revolutionary path around the sun, the northern hemisphere is closer to the sun for some time, and then when it completes half (1/2) the revolution, the southern hemisphere comes closer to the sun. So basically, the earth's axis remains tilted in the same direction all through the revolution which causes the changes in seasons.

Now, because of the tilted axis, the two hemispheres never have the same season at the same time. When one hemisphere has a particular season, the other hemisphere has a different season altogether. Therefore to study the different seasons, let us see the positions of the earth and the different seasons experienced during different months of the year.

Position of the Earth Around the Sun in each Season



The diagram shows that different parts of the earth are closest to the sun at different times of the year.

Countries located in the tropics have only two seasons (wet and dry) all the year round, while the countries in the temperate regions have four seasons (summer, autumn, winter, spring). Spring and autumn are intermediate seasons in between summer and winter.

- **December, January and February**

In these months, when the earth tilts, the southern hemisphere is closer to the sun. The northern hemisphere is far away from the sun. Therefore, the southern hemisphere will be warmer. It is summer time in the southern hemisphere while winter in the northern hemisphere.

- **March, April and May**

This is the first set of transitional (changes), where the northern hemisphere starts coming closer to the sun, and the southern hemisphere starts drifting away from the sun. So it is like warming up in the northern hemisphere, bringing spring in countries in

that hemisphere. The southern hemisphere on the other hand starts cooling down, bringing autumn.

- **June, July and August**

In the months between June to August, the northern hemisphere starts coming closer to the sun, with the axis at the north pole pointing towards it. The southern hemisphere on the other hand moves further away from the sun. During these months, the countries in the northern hemisphere experience summer while the countries in the southern hemisphere experience winter.

- **September, October and November**

This is the second set of transitional months, where the northern hemisphere starts moving further away from the sun while the southern hemisphere starts coming closer to the sun. The countries in the northern hemisphere start cooling down, while the countries in the southern hemisphere start warming up. Hence, during these months, the northern hemisphere experiences autumn, while the southern hemisphere countries experience spring.

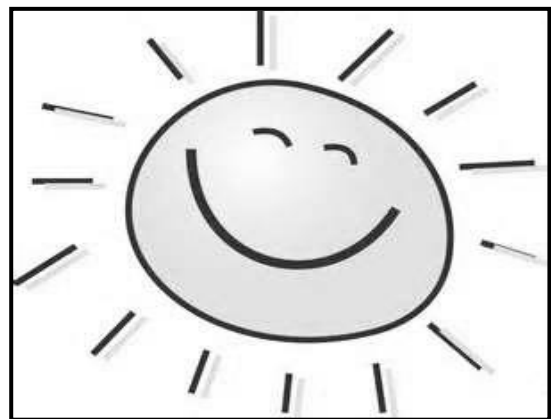
However, Polar Regions do not see the sun at all in winter. They have 24 hours of darkness. Although in summer, Polar Regions have 24 hours of daylight.

Below are pictures of winter and summer in different parts of the world in the northern and southern hemisphere. Snow is common during winter season.

Photographs of winter season



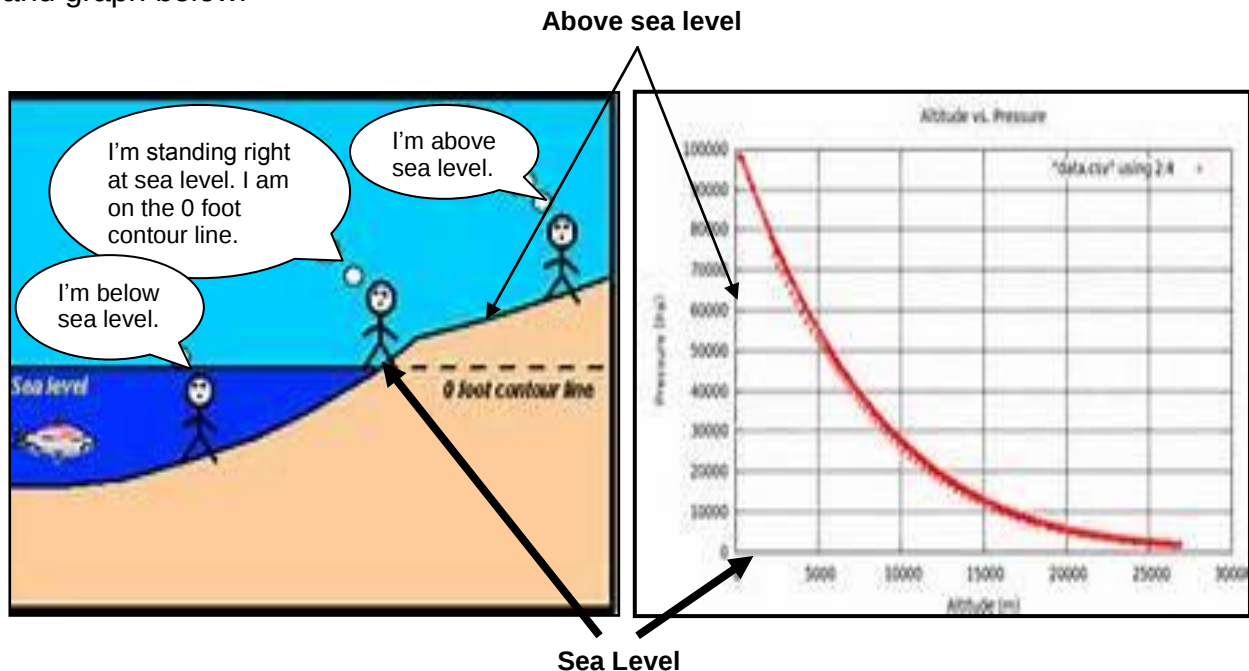
Flowers bloom and plenty of sunshine during summer season



These pictures give you some idea of what it looks like during these seasons.

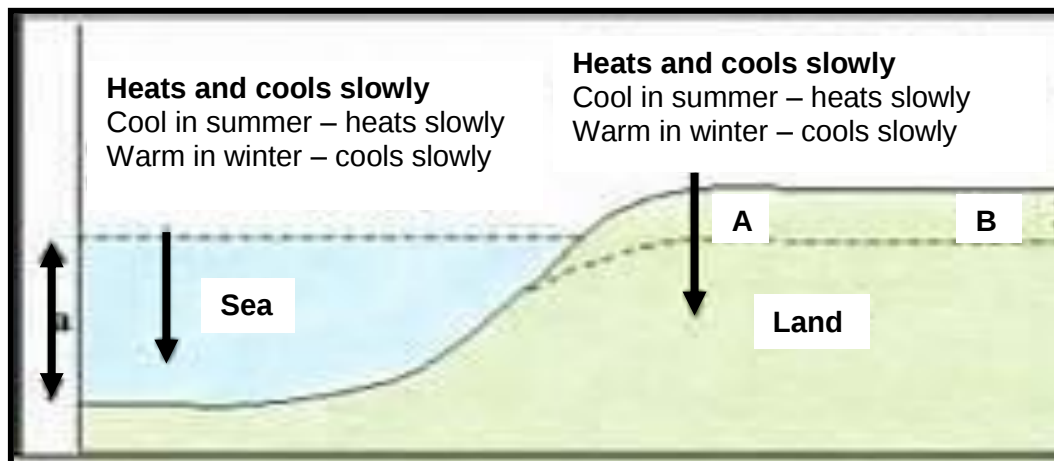
iii) Altitude

Altitude refers to the height above sea level. The higher the altitude of a place, the lower the temperature (cold). The lower the altitude, the higher the temperature (hot). Even some places in the tropics are so high up that they are permanently covered in snow. The height above which snow is permanent is called snowline. See diagram and graph below.



iv) Distance from the sea

Places near the sea are cooler in summer and warmer in winter than places a long way from the sea. Therefore, location **A** is hotter than location **B** on the diagram below. The reason for this is that, land heats up quickly but loses heat very quickly. The sea on the other hand, takes a long time to heat up and a long time to cool down.

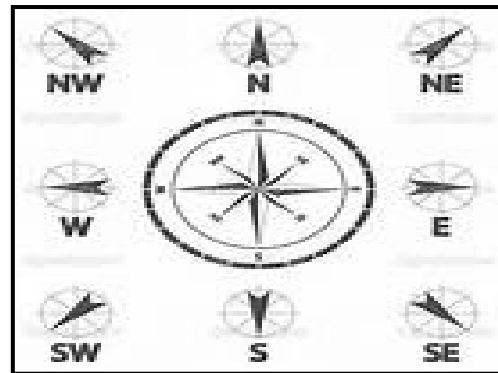


The land becomes very hot during day. However, at night the same land becomes very cold. Water becomes warm at night. This is because water holds the heat of the day much longer than land.

v) Air Movement

The direction the wind comes from affects the climate. The air picks up most of its moisture when it crosses the sea.

If the wind blows mainly from the sea, towards the land, the land will have a lot of rainfall. However, when the wind blows from the land to the sea, the land will be very dry.



Wind Direction

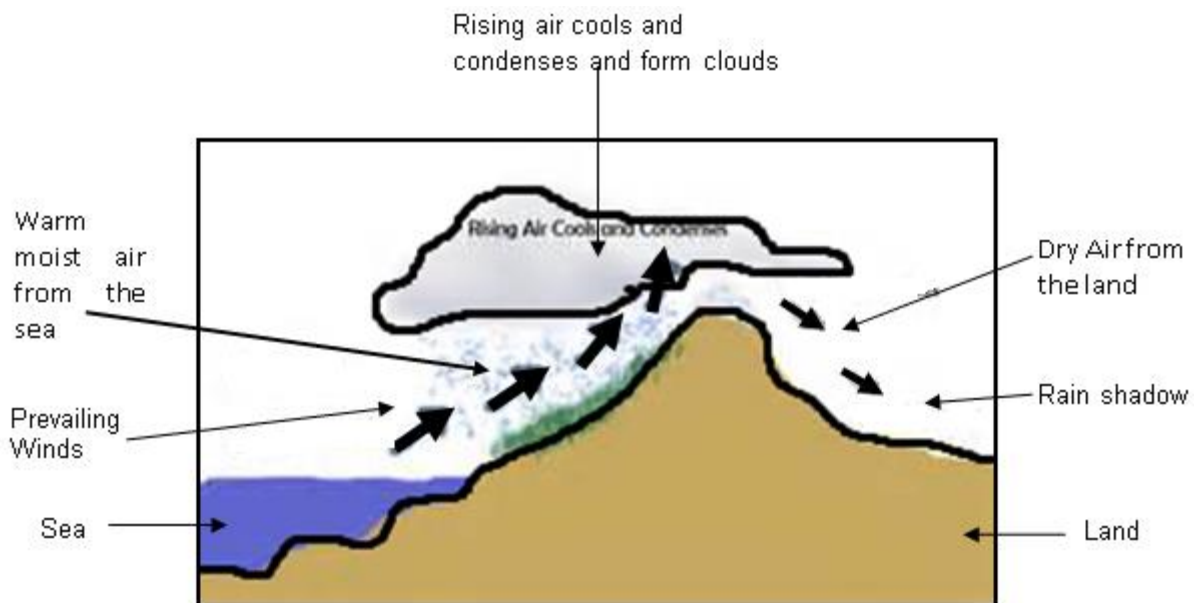
vi) Precipitation

Precipitation is any form of liquid or water which falls from the air. Rainfall is one form of precipitation. In Papua New Guinea it rains a lot.

The air contains a large amount of **water vapour**. During the day, the sun's heat causes water to **evaporate**. Before the moisture can be returned to the earth as liquid water, the vapour must condense. Water vapour condenses when it is cooled.

When air rises it becomes cooler. Water vapour in rising air **condenses** into droplets as the air becomes cooler. Water droplets can be seen in the air as clouds.

As the droplets become larger and larger, the clouds become dark grey and fall as rain. In cold climates, the moisture freezes and falls as snow. See diagram below.



vii) Monsoon Winds

Monsoon winds are winds that change direction in each season with very heavy rain. Monsoon winds are mainly found in the tropical part of the world which are wet and have a lot of rainfall.

Monsoons occur when the temperature on land is warmer or cooler than the temperature of the ocean. These different temperatures are caused because the oceans and land absorb (take in) heat in different ways.

Monsoon winds blow from Asia to Australia, (northwest to the southeast) from December to April. At this time, it is winter in Asia while summer in Australia.

These winds change direction and blow from Australia to Asia. The winds that blow out of Asia are dry. This means that most of South East Asia have dry season from December to April.

As the winds cross the equator, they pick up a lot of moisture from the sea. When they reach Papua New Guinea and North Australia, the moisture falls as rain. Papua New Guinea and North Australia have their wettest season between December and April. From May to November, it is summer in Asia and winter in Australia.

The winds that blow out of Australia are dry. This means that most of North Australia and Port Moresby area have a dry season from May to October. They pick up moisture from the sea. When the winds reach South East Asia, the moisture falls as rain. South East Asia has its wettest season between May and October.

The pictures below show us the effects of monsoon winds. The monsoons are very dangerous. They destroy thousands of households, farms, factories, cities and more. Together with the monsoon winds come the monsoon rains. These are very heavy rains resulting in floods. Therefore, it is very important for weather forecasters to know when the monsoons arrive.

Weather forecasters inform people so that they are prepared for the disaster. As we have learnt, there are certain times when monsoons arrive so at least people are prepared.



Examples of monsoon rain

What are seasons?

Seasons are subdivisions of the year. The year is being divided into seasons. A season is marked by change in weather and hours of day light. The seasons of the year differ with the climatic zones of the world.

Tropical and sub-tropical

There are basically two seasons in the tropics. It is wet and dry all year round. The wet (rainy/monsoon) season begins from May to October. This season is called winter. The dry season is from April to November. It is called summer.

Temperate or sub-polar regions

In these regions, there are four calendar based seasons and they are spring, summer, autumn and winter. Therefore, for the Northern hemisphere, spring begins on 1 March,

summer on 1 June, autumn on 1 September, and winter on 1 December. For the Southern hemisphere, spring begins on 1 September, summer on 1 December, autumn on 1 March, and winter on 1 June.

Polar Region:

The polar region is cold all year round. It is the coldest with temperatures always below freezing.

**Summary**

You have come to the end of lesson 4. In this lesson you have learnt that:

- climate is the long term weather of an area (at least 30 years).
 - weather is the short-term condition of the atmosphere.
 - climatic zones are divisions of the earth's climates according to average temperature and rainfall.
 - the three main climatic zones are the tropical, sub-tropical, temperate and the polar regions.
 - climates are different in places because of the angle of the sun, the rotation of the earth, air movements, seasons, altitude, distance from the sea, precipitation and monsoon winds.
 - seasons are sub-divisions of the year marked by weather and hours of the day.
 - each climate zone has its own seasons.
 - monsoons are strong sea breezes which occur due to differences in the temperature on the land and the sea.
-

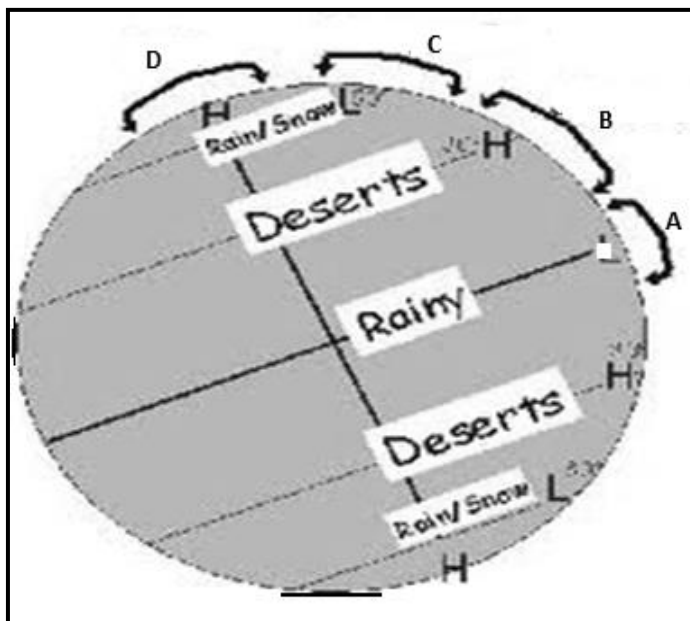
NOW DO PRACTICE EXERCISE 4 ON THE NEXT PAGE
--



Practice Exercise 4

1. Climate classification is based on _____ and _____.
2. What is the difference between weather and climate?

3. On the diagram below name the climate zone indicated by the letter.



- A. _____
- B. _____
- C. _____
- D. _____

4. What are the factors that make the climate different in different places?

5. What are the seasons in the temperate region?

6. What season is it in Asia and Australia, from May to November?

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 1

Lesson 5: Climatic Zones and Distribution



Welcome to lesson 5. This is a continuation of the previous lesson which you have just completed. In lesson 4, you were introduced to climatic zones. You have identified the major climatic zones and their seasons. Lesson 5 will show you the distribution of the different climatic zones of the world. We will basically study world maps showing climatic zones.



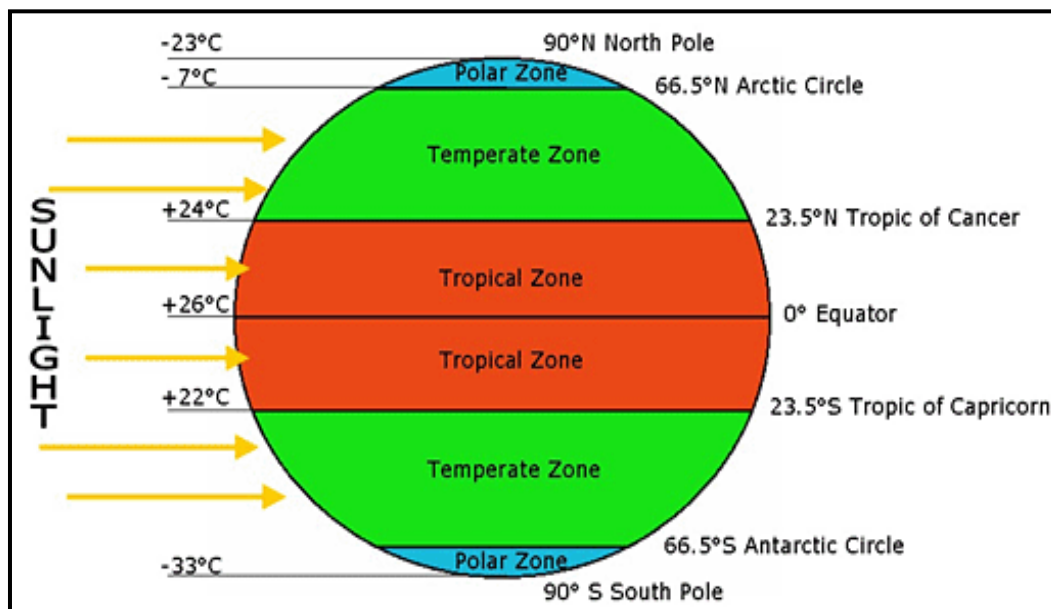
Your Aims:

- show the distribution of major climatic zones of the world

As we have learnt so far, the world's climate consists of three main climatic zones. Below is a list of them.

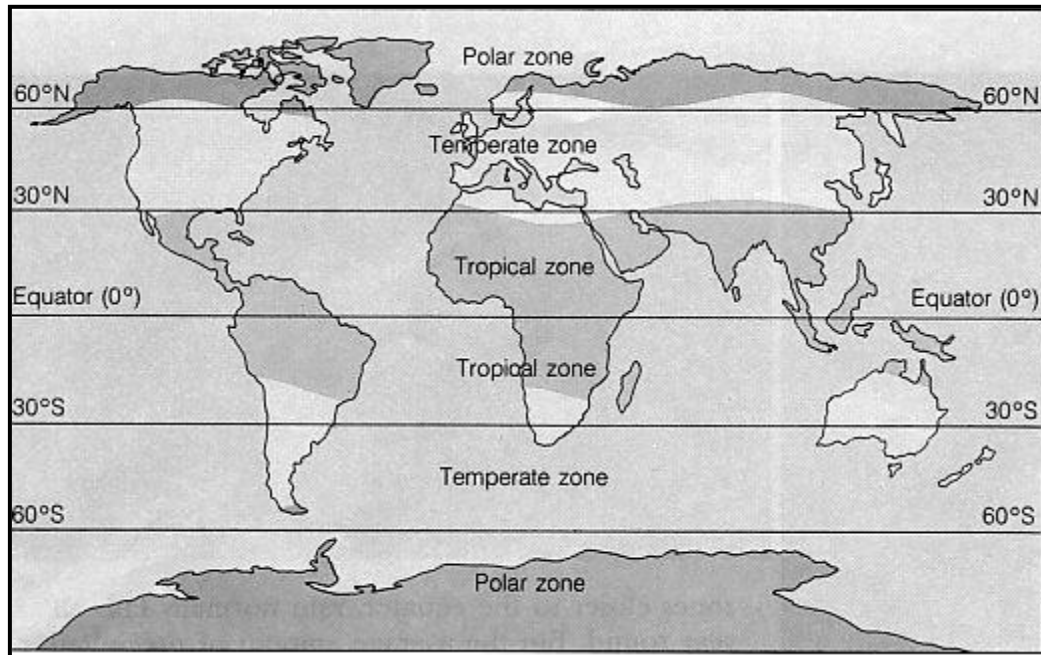
- The Tropical Zone
- The Temperate Zone
- The Polar Zone

This diagram of the sphere which represents the earth shows clearly how the climatic zones are distributed.



Now look at this map of the world. The map tells us which places are located in each climatic zone. You can use an atlas to locate the places of the world.

Map of the World's Climatic Zones



From the above information we can be able to identify the seasons of each of these climatic zones.

The **tropical zone** starts from the equator from 0 to 15 degrees. It is mostly wet and dry. Temperatures differ at subtropical zones. It is often dry in desert areas. The **wet season, rainy season** or **green season**, is the time of year, covering one or more months, when most of the average annual rainfall in a region falls.

Tropical plants and animals are those species native to the tropics. Tropical ecosystems may consist of rainforests, dry deciduous forests, spiny forests, desert and other habitat types.

Below are examples of plants and animals you are likely to find in the **tropics**.





Temperate Zone has four seasons in a year. The weather changes during the year: it is hotter during the summer, colder in winter, and somewhere in between during spring and fall. These are the *seasons*, a regular change in temperature, that repeat them every year, more or less regularly.

The **North Temperate Zone** extends from the Tropic of Cancer (at about 23.5 degrees north latitude) to the Arctic Circle (at approximately 66.5 degrees north latitude).

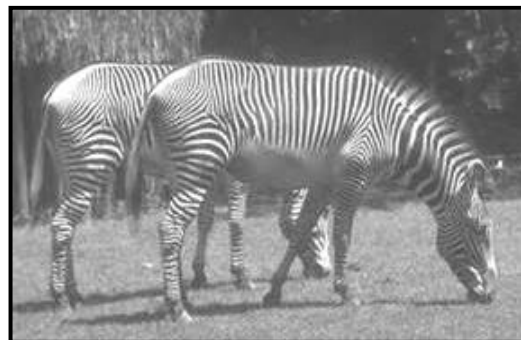
The **South Temperate Zone** extends from the Tropic of Capricorn (at approximately 23.5 degrees south latitude) to the Antarctic Circle (at approximately 66.5 degrees south latitude).

In terms of complete months, in most North Temperate Zone locations, **spring** months are March, April and May, although differences exist from country to country.

South Temperate Zone locations will have opposing seasons with **spring** in September, October and November.

Summer is June, July, August; **autumn** is in September, October, November and **Winter** is in December, January, February.

Examples of plants and animals you are likely to find in the **temperate** regions.



Examples of plants found in temperate regions



The **Polar zones** are the coldest. These regions are covered with snow and ice. They produce dry and icy winds that blow outward from the north and south Poles.

The Polar Regions are the coldest places on earth and differ most from every other habitat on the planet. During the summer months, the days receive 24 hours of pure sunshine, but during winter, the sun is barely seen at all.

Animals that inhabit nature's freezers have to be well adapted to living in the cold, and often have a thick layer of fat to help to keep them warm.

There are two main Polar Regions in the world, which are the **Arctic** and the **Antarctic**. The Arctic Circle and Arctic Tundra are found at the North Pole, and it covers nearly 5 million square miles of the top of the Northern Hemisphere.

The **Antarctic** is found at the South Pole, and although the animals are very different here, the Polar Regions are fairly similar places to live.

The **Arctic** is made up of ice floating on the ocean and the Antarctic is a rocky continent covered in ice. There is very little rainfall in the Polar Regions, mainly because it is so cold, that there is very little water in the air.

The main difference between the North and the South Pole is that the Arctic is connected to Europe and Canada, meaning that there are more species of both animals and plants than in the Antarctic which is completely isolated from the rest of the world.

Images of the Polar Regions





Summary

You have come to the end of lesson 5. In this lesson you have learnt that:

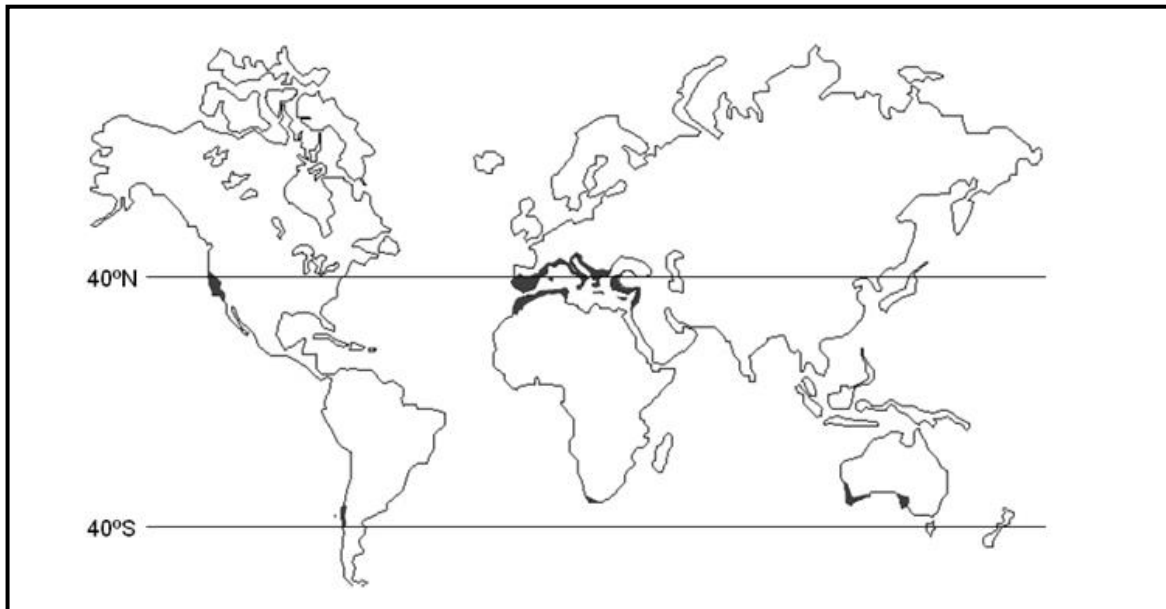
- the three main climatic zones are, tropical, temperate and the polar regions.
- tropical zones have wet and dry seasons.
- sub-tropical zones have dry seasons towards the temperate regions.
- temperate regions consist of four seasons, spring, summer, winter and autumn.
- polar regions are covered with snow and ice. They are at the North Pole and the South Pole. They are the coldest zones of the world.

NOW DO PRACTICE EXERCISE 5 ON THE NEXT PAGE



Practice Exercise 5

1. On this blank map of the world;



- a) Indicate the climatic zones by drawing the latitudes which separate them.
b) Colour each climatic zone with different colours to make it clear.
2. Complete this table;

Climate Zones and their Seasons

Climate zone	Characteristics/Seasons
Polar	
Temperate	
Sub-tropical	
Tropical	

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 1

Lesson 6: Major Winds



Welcome to lesson 6. In lessons 4 and 5 we touched on winds or the air pressure. In this lesson we will study the major wind patterns of the world.



Your Aims:

- define wind
 - identify the major winds and their importance
-

Wind is the invisible or unseen movement of air from one place to another. It is caused by the differences in the atmospheric pressure.

For example; you have a balloon fully blown. The balloon is full of air. Imagine what happens when you open and let go of the air. The air rushes out. This is wind. It moves from the balloon where the pressure is high, into the open where the pressure is low.

Similarly, in the atmosphere, there are many differences in pressure causing air to move. Air moves from areas of high pressure to areas of low pressure. The strength of the wind depends on the difference in pressure between two points. The bigger the difference in pressure, the faster the wind blows.

The major wind systems

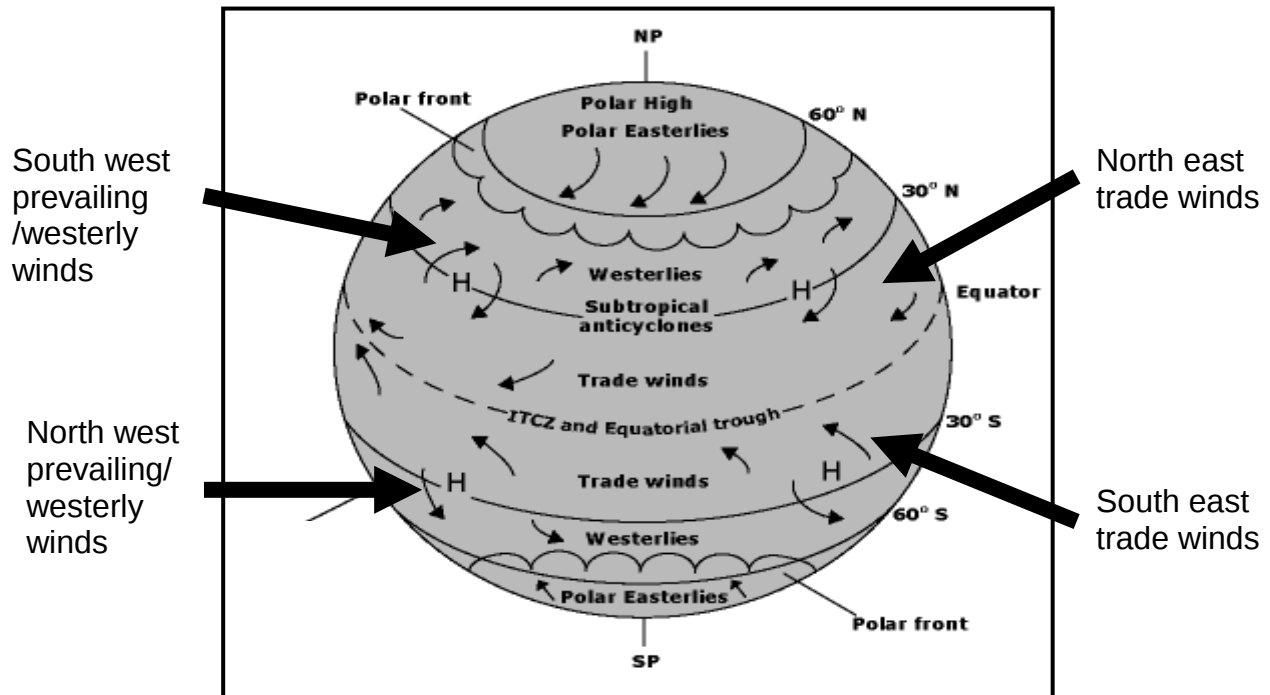
Winds are very important in making climate zones. There is a worldwide system of winds. This system of wind carries warm and cold air long distances around the world. It carries warm air away from warm areas. It also carries cold air away from cold areas. This is called the general circulation of the atmosphere. Here are the types of winds.

- Trade Winds
- Easterlies
- Prevailing Winds/Westerlies
- Polar Fronts

Winds around the world are created by the differences between hot and cold air. Heat from the sun makes the air particles to move around. Hot air rises, leaving a space behind. Cooler air flows into that space. The heat rises around the equator. It cools and sinks around 30 degrees to the north and south of the equator. This is repeated until you reach the South Pole and the North Pole. Air is always moving around the earth.

Air moves from areas of high pressure to areas of low pressure

Below is a diagram which shows the major wind systems and the wind directions



Trade winds

Trade winds blow from the tropics and the subtropics where the air pressure is high. The trade winds are between 30 degrees from the equator.

In the Northern hemisphere, the trade winds blow from the north east and are known as the north east trade winds. These winds blow from November to April.

Places located between 0 to 30 degrees north of the equator such as, Philippines, Mexico, Indonesia, Nigeria, Ethiopia and Sri Lanka experience wet/ rainy seasons especially monsoon from November to April.

In the southern hemisphere, the winds blow from the south east and are called the south east trade winds. These winds blow from May to October. Places located between 0 to 30 degrees south of the equator such as, Brazil, northern part of Australia, Papua New Guinea, Indonesia and Tanzania also experience wet seasons mainly orographic or relief rainfall.

Prevailing Winds or the Westerly winds

These are most frequent winds within a specified period in mid-latitudes (35 to 65 degrees latitudes). In other words, it refers to the winds of the temperate regions of the world.

Prevailing winds blow across from the west to the east. The winds blow from the south west in the northern hemisphere and from the North West in the southern hemisphere. Westerlies occur at areas of low pressure. Therefore, they are the strongest in winter when the pressure is low.

Polar Fronts

Polar refers to places close to the north and the south poles.

Polar Front is the boundary separating the air masses of the polar region and those of tropical or subtropical regions. In summer, polar fronts move northwards and in winter they move southwards. The convergence (meeting/coming together) of warm and cool air masses along the polar front often produces cyclonic wind systems.

Polar Easterlies

These are winds which dominate the flow pattern across the poles. The polar easterlies blow from the east to the west from polar highs (high pressure areas) to polar lows (low pressure areas).

Polar high is a mass of cold heavy air centred at the poles and produced by downward air currents. This brings high pressure at high latitudes.

Now these are basically the major wind systems around the world. As you read through the notes under each of these wind systems, relate to the diagram above. The diagram will help you with the directions and the climate zones.

The importance of wind systems

Winds are very important because they enable the formation of climate zones. There is a worldwide system of winds. This system of wind carries warm and cold air long distances around the world. It carries warm air away from warm areas. It also carries cold air away from cold areas. This is called the general circulation of the atmosphere.

Rainfall in different parts of the world is influenced by the movement of the wind. Rainfall changes from place to place. Rain comes at certain times of the year which is influenced by the direction of the major wind systems.

The differences in heating by the sun causes different pressure systems to be built. This in turn causes winds to blow from high pressure areas to low pressure areas. Cold air is associated with dry conditions while warm air brings rainy conditions.

**Summary**

You have come to the end of lesson 6. In this lesson you have learnt that:

- wind is moving air.
- wind blows from the areas of high pressure to areas of low pressure.
- the strength of wind depends on the differences in pressure between two points.
- the major wind systems include; trade winds, westerlies, polar fronts, polar easterlies.
- trade winds revolve around the tropics causing wet and dry seasons.
- westerlies are found mainly in the temperate regions where there are four seasons. Prevailing winds blow across from west to east.
- polar front is a separation of the air masses between the polar origin and the tropical origin.
- polar easterlies are winds which dominate the flow pattern across the poles.
- rainfall in different parts of the world is influenced by the movement of the wind.
- winds are very important because they enable the formation of climate zones.

NOW DO PRACTICE EXERCISE 6 ON THE NEXT PAGE



Practice Exercise 6

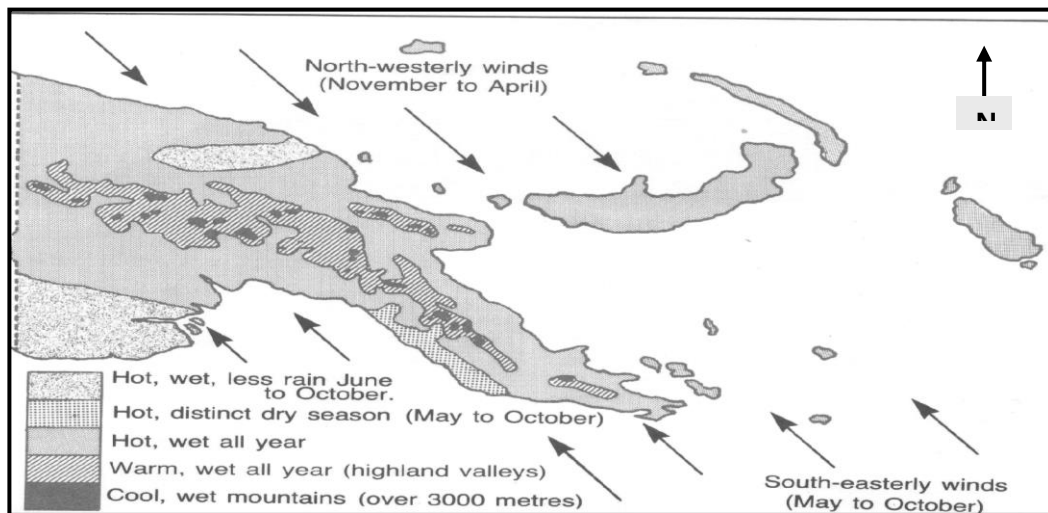
1. _____ moves from areas of _____ pressure to areas of _____ pressure.
2. What determines the speed of wind?

3. How is wind created?

4. In which direction do the trade winds blow in the southern hemisphere?

5. The map shows that Papua New Guinea has two main winds that blow at different times of the year.

BROAD CLIMATIC REGIONS OF PAPUA NEW GUINEA



- (i) What winds blow from November to April?

- (ii) What season would you experience from November to April?

- (iii) From May to October, the winds change direction. They blow from the south-east. What season would you experience during that period?

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 1

Lesson 7: Continents



Welcome to lesson 7. In lesson 6 you have learnt about the major wind patterns. In this lesson, you will learn about land masses which together form the planet. These land masses are called continents.



Your Aims:

- define continent, continental drift, tectonic plate and continental shelf
- discuss the processes that have formed continents
- identify the major continents of the world

Hello! How much do you know about the earth you are living on? Did you know that your beautiful Papua New Guinea is sitting on a huge land mass? Have you ever wondered how Papua New Guinea came to be? These are questions you should have in mind. As future social scientists, we are going to begin our study on that big landmass Papua New Guinea is sitting on. We will also find out how Papua New Guinea came to be. Before you start on your study, you must know the meanings of these words.

What is a continent?

Continents are very large land masses on earth. A continent is a big area of dry land on earth. A continent is mostly surrounded by oceans. You can only see an ocean if you are on the edge of a continent.

All the countries of the world are sitting on a continent. A group of countries make up a continent. For example, the African continent is made up of all the countries in Africa.

Some geographers say the earth has seven continents. Others say six because they count Europe and Asia as one continent called Eurasia.

Some continents are joined together like the North and South America and Europe and Asia. Australia is surrounded by oceans. It is often referred to as an 'island continent'. Some people believe that North and South America are all part of one continent connected by Central America. They call this continent 'America'.

Listed below are the continents of the world. They are arranged from the largest to the smallest according to the size of their land mass.

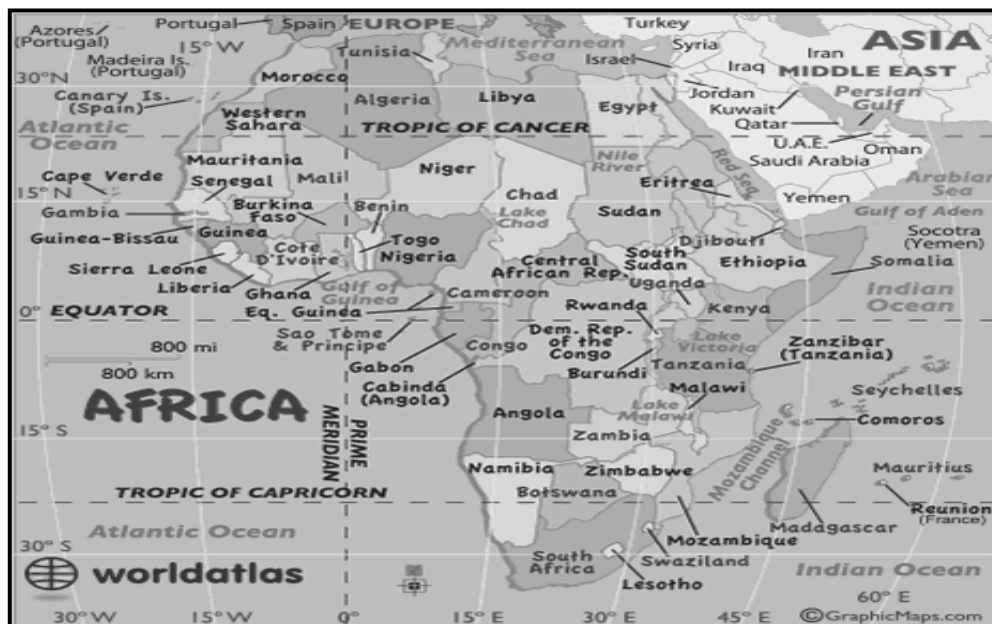
- Asia, Africa, North America, South America, Antarctica, Europe and Oceania (Australia)

These maps show the continents of the world. The continents are shaded with different colours in order to identify them clearly. Study and find out the countries which come under each continent.

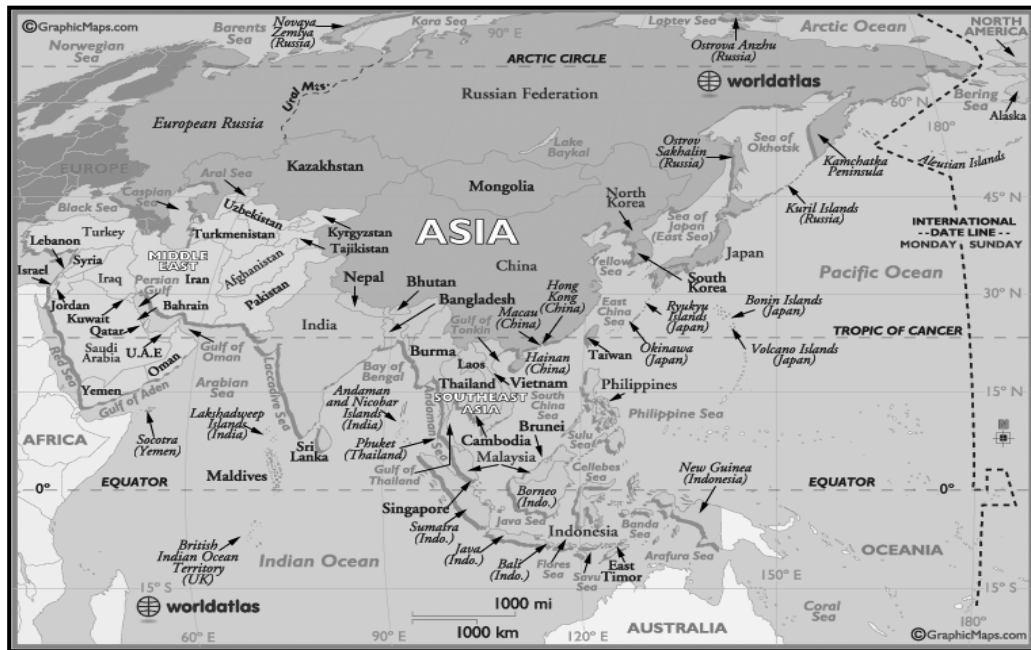
Continents of the World



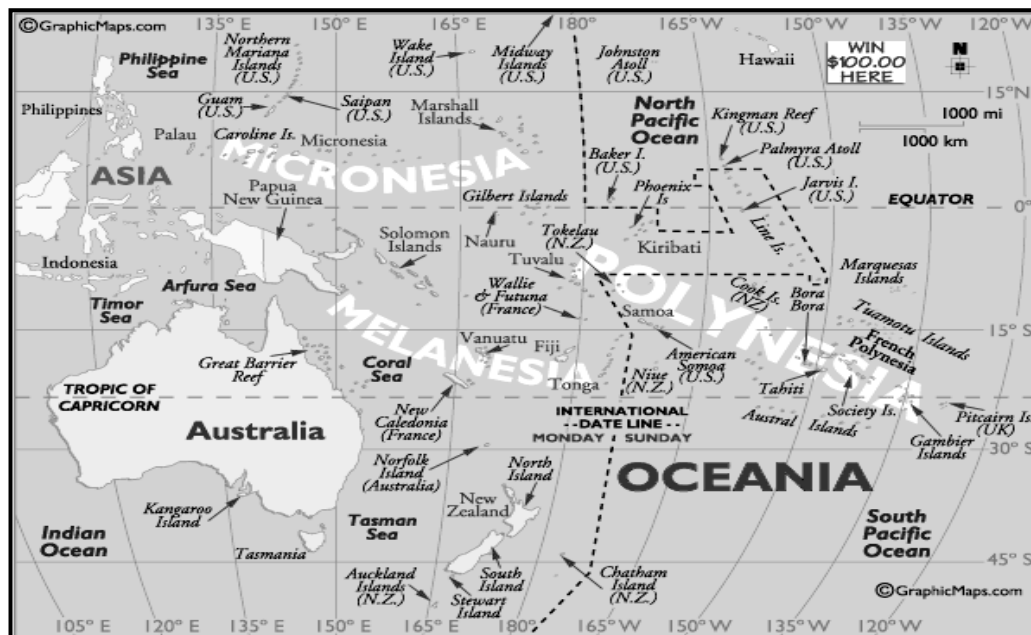
Map of African Continent



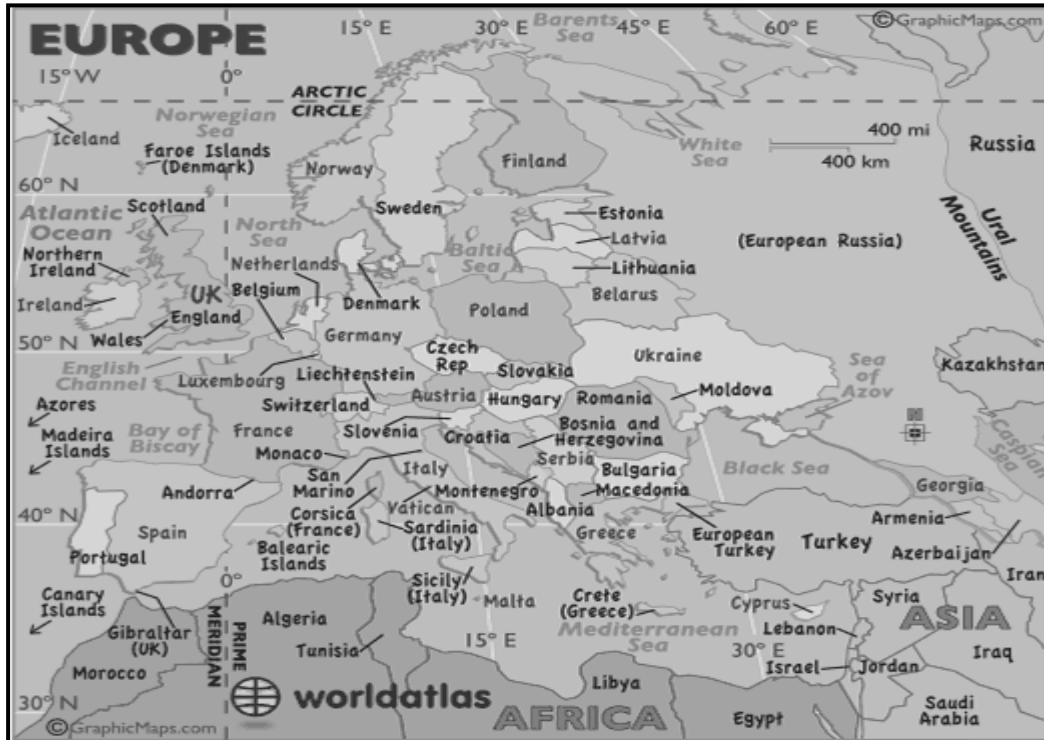
Map of the Asian Continent



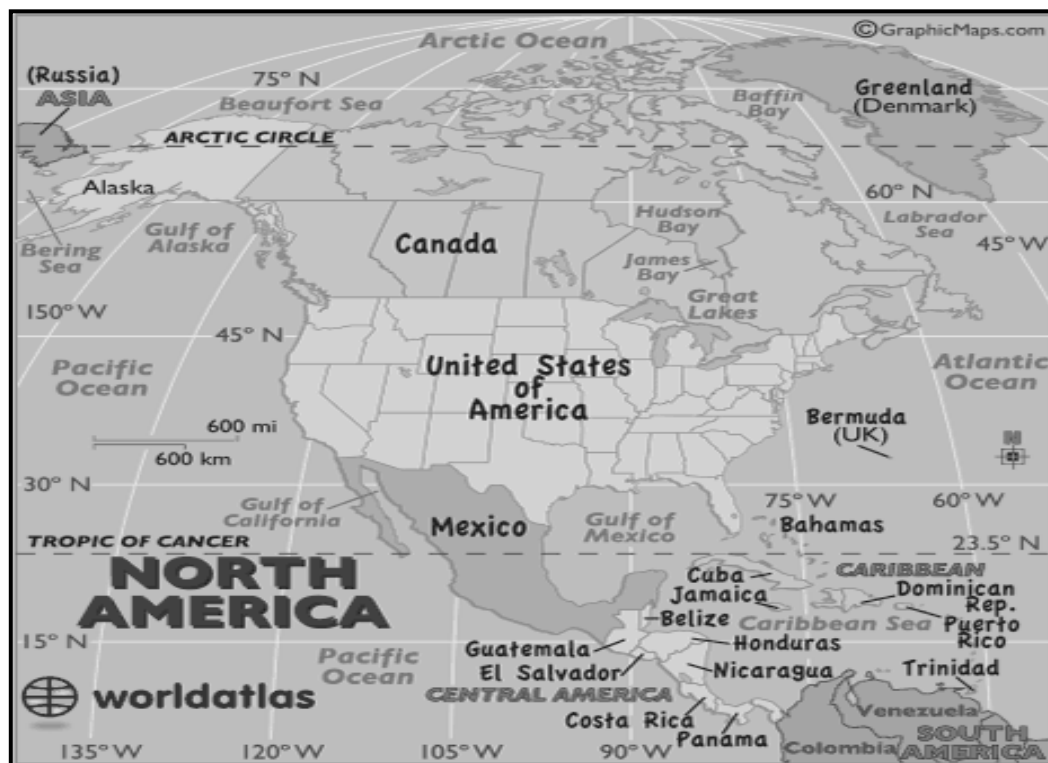
Map of Oceania



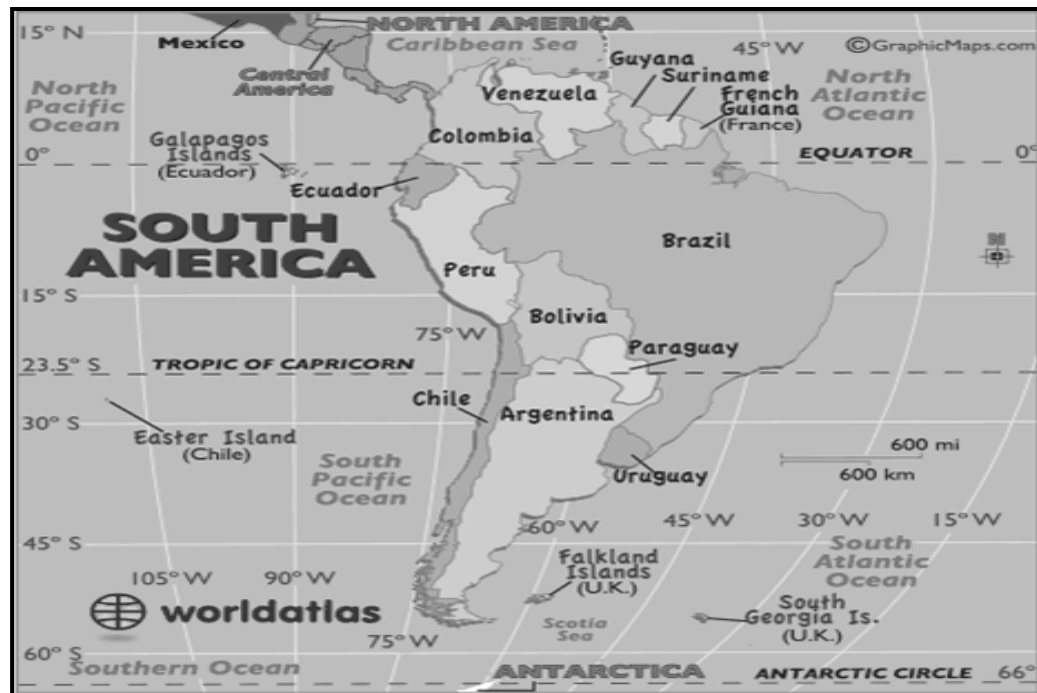
Map of Europe



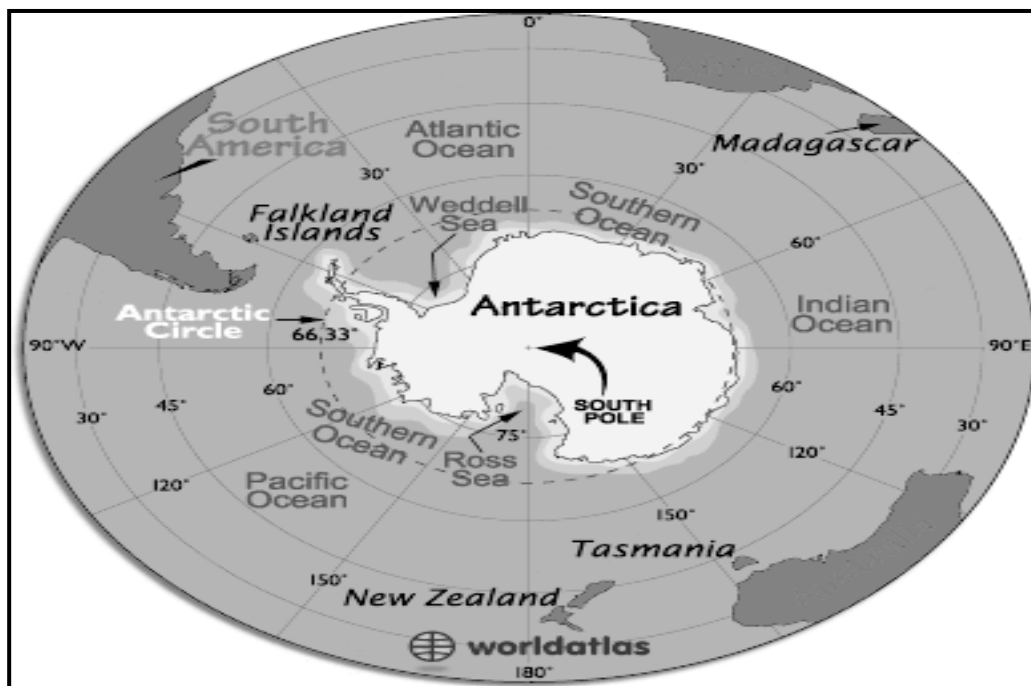
Map of North America



Map of South America



Map of Antarctica



Facts about Continents

Continent	Population (2007 estimates)	Area (square kilometres)
Africa	936,000,000	30,200,000
Antarctica	N/A	14,000,000
Asia	4,000,000,000	44,400,000
Australia	33,500,000	8,490,000
Europe	727,000,000	10,400,000
North America	524,000,000	24,200,000
South America	380,000,000	17,800,000

How were the continents formed?

The continents were formed due to continental drifts, tectonic plates, volcanic activities or earthquakes.

Let us take a look at tectonic plates. These are moving crusts. The crust is the outer layer of the earth. Plates are always moving underneath the continents and the oceans. As you have learnt in Grade 7, moving plates form different landforms. They form mountains, valleys and ocean trenches. From this information, we can now confirm that **continents were formed by the earth's movement**.

The **movements of plates** have caused the formation and break-up of continents. Plates move in all directions. If two plates collide (move towards) each other, they push the crust up and form Fold Mountains. For example, the **Himalayas**, the world's tallest mountain range, have been formed by the collision of two major plates.

Plates may also diverge. When they move away from each other, in that case, they form mid-ocean ridges, for example, the Mid-Atlantic Ridge.



Hills formed from volcanic activity

Volcanic Activity also adds to the formation of the continents. Volcanic landforms result from the cooling of magma. The hot magma escapes through the crust along faults or line of weakness in the earth's crust. Volcanoes throw out solid and broken pieces of materials as well as lava. They also throw out hot gases and steam. There are mountains which were formed through volcanic activity as they cooled off.

As a result of all these natural processes, continents were formed. Continents move slowly on tectonic plates. These movements have created mountain ranges and other physical features on the earth's surface over millions of years.

What Do Continents Look Like?

Continents have all types of landforms such as plains and mountains, deserts and lakes. People build cities on continents. Almost all of the people on earth live on continents. More people live on Asia than on all the other continents combined.

The edge of a continent touches the ocean. The edge of a continent can be smooth, sandy beach. It can be made of steep, rocky cliffs. The edge of a continent slopes down into the sea.

What is a continental shelf?

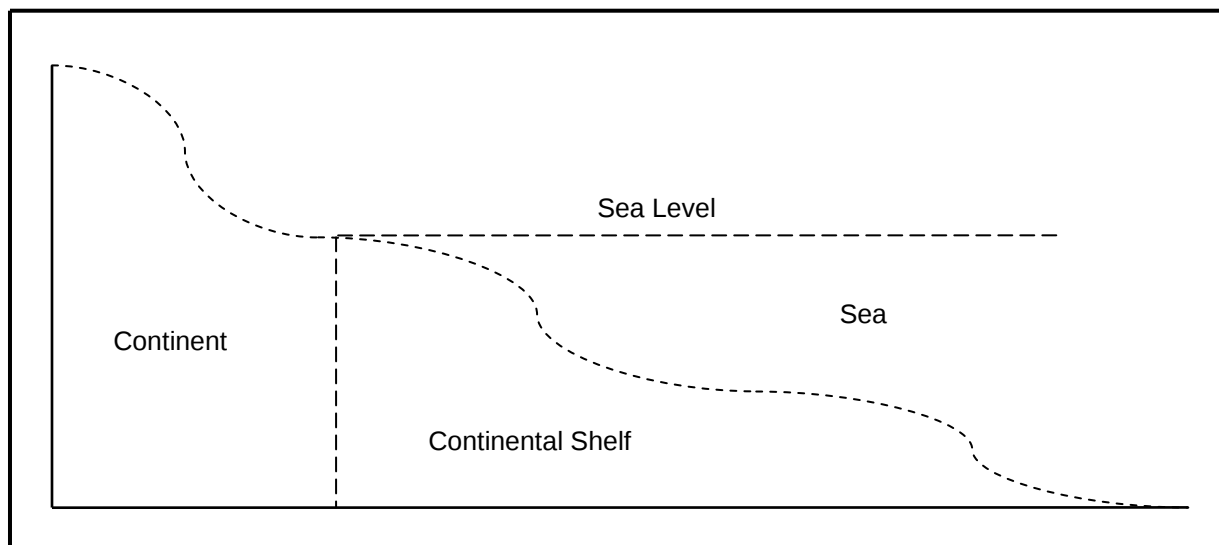
A continental shelf is part of the continent that is under water where it meets the sea.

The area has water which is very shallow or the water is not deep. These areas may have islands which were part of the continent but are underwater. Continental shelf typically extends from the coast to depths of 100 to 200 metres. They extend along the coastlines of the continents bordering the Pacific Ocean.

Off North and South America, the shelves are narrow. The shelves are wider along Australia and Asia. Continental shelves are the zones of the oceans that are nearest to the surface.

They are characterised by abundance of sunlight and warmth. These conditions create a good environment for fish to breed.

Refer to the diagram below and identify the continental shelf



Continental drift is a belief or theory. Millions of years ago continents were joined as one single land mass. For example, the Sahul and Sunda land which you learnt in Grade 7. But these big landmasses were later broken and drifted apart from each other and they have formed continents and countries.



Summary

You have come to the end of lesson 7. In this lesson you have learnt that:

- continents are large land masses on earth.
- there are 7 continents of the world and they are Asia, Africa, North America, South America, Antarctica, Europe, Oceania (Australia).
- continental shelf is a part of the continent that is under water or the sea.
- a continental drift is a theory which states that continents were once joined together as one single land mass.
- the movement of plates has caused the formation and break-up of continents.
- plates are pieces of the earth's crust. Tectonic is the movement of the crust.
- plate tectonics are pieces of moving crust.
- plate tectonics have a greater impact on the formation of continents.
- the movement of plates has resulted in the formation of mountains, valleys, volcanoes, mid-ocean ridges and trenches.

NOW DO PRACTICE EXERCISE 7 ON THE NEXT PAGE



Practice Exercise 7

1. Use the maps given in the notes to complete the table.
Name 5 countries for each of the continents.

Asia	Africa	North America	South America	Europe	Oceania

2. How were the continents formed?

3. What happens when plates move?

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 1

Lesson 8: Oceans and Rivers



Welcome to lesson 8. In lesson 7, you have learnt about the 7 continents of the world. In this lesson, you will learn about the oceans and rivers of the world.



Your Aims:

- define ocean, ocean currents and rivers
- identify the oceans and major rivers of the world



What is an ocean?

An ocean is one of the large bodies of saltwater on the earth.



Oceans are large bodies of saltwater covering much of the earth's surface. The oceans cover more than 70% of the earth's surface, containing roughly 97% of the earth's water supply.

The ocean has many living and non-living things in it. There are trillions of fish and plants such as algae, plankton, coral, crustaceans, sea shells and rocks in the ocean.

How many oceans do we have in the world?

There are five oceans, the **Arctic**, **Atlantic**, **Indian**, **Pacific**, and **Southern (Antarctic)** ocean. They are, in descending order of area, the Pacific, Atlantic, Indian, Southern (Antarctic), and Arctic oceans.



Oceans of the world

Their borders are indicated on the world image (*left*) in varied shades. For many years only (4) four oceans were officially recognised.

Then in the spring of 2000, the International Hydrographic Organisation established the Southern Ocean, and determined its limits.

Those limits include all water below 60 degrees south, and some of it, like the Arctic Ocean, is frozen.

- **The Atlantic** covers an area of 82 million square kilometers. It has an average depth of 3,600 meters. Its greatest depth is in the Puerto Rico Trench at 8,605 meters (28,231 feet).
- A smooth, pale-blue layer of polar pack of floating ice covers much of the frigid waters of the **Arctic Ocean**, the earth's northernmost cap. With an area of 12 million square kilometers. The Arctic Ocean is the smallest ocean, more than five times smaller than the Indian and Atlantic oceans.
- The smallest of the three major oceans, the **Indian Ocean** covers an area of about 73 million square kilometers, about 20 percent of the total area covered by the world's oceans. The average depth of the Indian Ocean is 3,890 meters. Its deepest point is the Java trench, at 7,725 m
- The world's largest geographic feature, the **Pacific Ocean** covers more than 166 million square kilometers, about one-third of the earth's surface. The area of the Pacific is greater than that of all of the continents combined, and it makes up nearly half of the area covered by the earth's oceans.
- The **Southern Ocean**, designated as such in 2000, is a body of water that lies between 60 degrees south latitude and the Antarctica coastline. The Southern Ocean has the unique distinction of being a large circumpolar body of water totally encircling the continent of Antarctica.

This ring of water lies between 60 degrees south latitude and the coast of Antarctica, and encompasses 360 degrees of longitude. The Southern Ocean is now the fourth largest of the world's five oceans (after the Pacific Ocean, Atlantic Ocean, and Indian Ocean, but larger than the Arctic Ocean).

What are ocean currents?

Ocean currents are the vertical or horizontal movement of both surface and deep water throughout the world's oceans.



What causes ocean currents?

Breaking waves, winds, temperatures, salinity differences and tides.



This movement is caused by currents moving in specific directions and help in the circulation of the earth's moisture, the resultant weather and water pollution. Oceanic currents are found all over the globe and vary in size, importance and strength.

There are two types of ocean currents;

i. Surface currents

Surface currents are those found in the upper 400 meters (1,300 feet) of the ocean and make up about 10% of all the water in the ocean.

Surface currents are mostly caused by the **wind** because it creates friction as it moves over the water. This friction then forces the water to move in a spiral pattern.

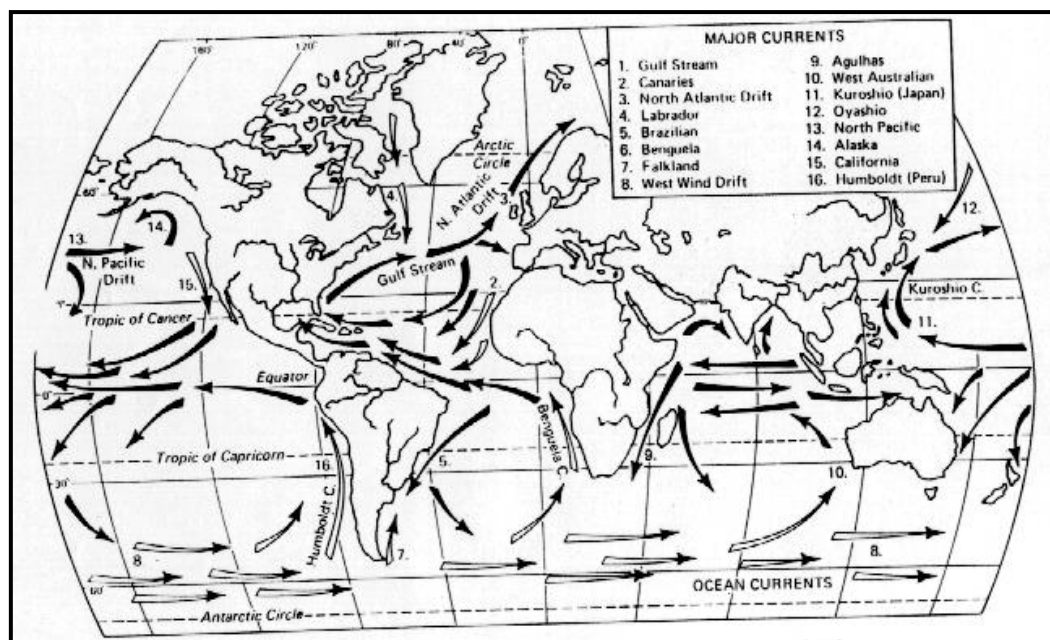
ii. Deep water currents

Deep water currents are found below 400 meters and make up about 90% of the ocean. Like surface currents, **gravity** plays a role in the creation of deep water currents.

Why are ocean currents important?

The oceans are important for **determining weather**. They act like a blanket. They collect and store heat because they receive 66% of all the solar heat that reaches the earth. They distribute this heat through currents. Some of the biggest oceans carry heat for great distances. They have an important impact on the movement of energy and moisture between the oceans and the atmosphere.

Major Ocean Currents



The warm currents are shown by dark arrows and cold currents are shown by open arrows.

The **Gulf Stream**, for example, is a warm current that originates in the Gulf of Mexico and moves north towards Europe. Since it is full of warm water, the sea surface temperatures are warm, which keeps places like Europe warmer than other areas at similar latitudes. Imagine, if the Gulf Stream stopped, much of Europe will be covered in snow and ice. It would have a very different physical environment.

The **Humboldt Current** is another example of a current that affects weather. When this cold current is normally present off the coast of Chile and Peru, it creates extremely productive waters and keeps the coast cool and northern Chile arid. However, when it becomes disrupted, Chile's climate changes and it is believed that **El Niño** (longer period of dry season) plays a role in its disturbance.

Another most important role of the ocean currents is the distribution of the world's sea life. Many species rely on currents to move them from one location to another whether it is for breeding or just simple movement over large areas.

Rivers

A river is a natural stream of fresh water larger than a brook or creek. A river flows toward another river, an ocean, a lake or other large body of water.

Streams that flow at a river source are the headwaters and are at the river's highest elevation. Most river headwaters begin in hills or mountain, but as the river flows downstream, it gains more water from other streams, rivers, springs, added rainfall and other water sources.

Rivers coming down from mountains flow very fast and at high speed. Those on flatter lands flow slowly. Rivers are parts of drainage systems. They let extra water flow from the land out to the sea.

Why are rivers important?

Rivers have always been important for travel, transportation and trade routes. Most settlements are built along major rivers.

Rivers are also important for farming because river valleys and plains provide fertile soil.

Farmers in dry regions irrigate their cropland using water carried by irrigation ditches from nearby rivers.

Rivers also are an important energy source. During the early industrial era, mills, shops, and factories were built near fast-flowing rivers where water could be used to power machines. Today steep rivers are still used to power hydroelectric plants and water turbines.

Rivers and the surrounding land drained by them (catchments) are very important wildlife habitats. The water itself provides the environment for fish, plants and animals, while the banks and nearby land support creatures such as otters, kingfishers and dragonflies and a variety of water-loving plants.

Longest Rivers in the World

River	Length in Kilometers	Continent
Nile	6650	Africa (North Africa)
Amazon	6400	South America(Brazil)
Chang Jiang (Yangtze)	6300	Asia(China)
Mississippi-Missouri	6275	North America
Yenisei	5539	Asia
Huang He (Yellow River)	5464	Asia (China)
Mackenzie	4200	North America (Canada)

The table above shows the names of the longest rivers in the world.



Summary

You have come to the end of lesson 8. In this lesson you have learnt that:

- oceans are large bodies of salt water covering much of the earth's surface.
- there are 5 main oceans of the world, the Pacific, Atlantic, Arctic, the Indian and the southern (Antarctica) oceans.
- ocean currents refer to the movement of the oceans caused by wind, breaking waves and temperature.
- ocean currents are important because they influence the weather and the distribution of sea life.
- rivers are natural streams of fresh water.
- rivers from the mountains flow much faster than rivers from flatter lands.
- rivers are vital for transportation, irrigation, producing electricity, home of wildlife.
- the longest river of the world is the river Nile in Africa.

NOW DO PRACTICE EXERCISE 8 ON THE NEXT PAGE



Practice Exercise 8

-
1. Papua New Guinea is in the middle of the _____ Ocean.
 2. What is the name of the ocean right at the tip of the North Pole? _____
 3. Which ocean is the largest? _____.
 4. Why are ocean currents important?

 5. Name two examples of ocean currents from the map given in the lesson.
i) _____ ii) _____
 6. Give two uses of rivers.
i) _____ ii) _____
 7. What is the second longest river in the world?
_____.
-

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 1
--

Lesson 9: Water Cycle



Welcome to lesson 9 of sub-strand 1. In your last lesson you learnt about oceans and rivers. In this lesson you will learn about water cycle and its importance in our environment.



Your Aims:

- define water cycle
- describe water cycle and its importance in our environment

Before you look at the importance of water cycle, you must first know the meaning of water cycle. Always remember that the amount of water on the surface of the earth is always in movement.

Water cycle is the continuous movement of water on, above and below the surface of the earth.

Water is important for all living things on earth. It works together with land, oceans and atmosphere to keep life going on earth.

There are six stages that make up the water cycle. They include;

1. **Condensation** – Condensation happens when a gas is change into a liquid.
2. **Infiltration** –This is a process where rain water soaks into the ground, through the soil and underlying rocks.
3. **Runoff** – Much of the water that returns to earth as precipitation runs off the surface of the land, and flows downhill into streams, rivers, ponds and lakes.
4. **Evaporation** – This is the stage where a liquid, in this case water, changes from its liquid state to a gaseous state.
5. **Precipitation** – When the temperature and the atmospheric pressure are right, the small droplets of water in clouds form larger droplets and precipitation occurs. The raindrops fall to the earth.
6. **Transpiration** - As plants absorb water from the soil, the water moves from the roots through the stems to the leaves. Once the water reaches the leaves, some of it evaporates from the leaves, adding to the amount of water vapour in the air. This process of evaporation through leaves is called **transpiration**.

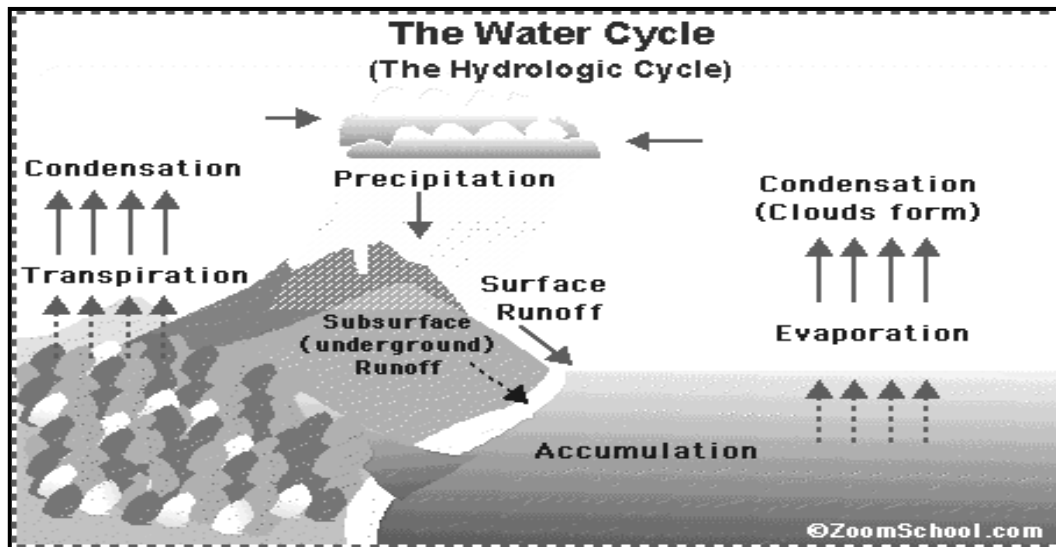


I wonder how water goes through a cycle.

I don't even know. Let us find out how it works in the diagram on the next page.



Now look at the diagram of water cycle.



The Sun's heat provides energy to **evaporate** water from the earth's surface (oceans and lakes.) Plants also lose water to the air (this is called **transpiration**). The water vapor eventually **condenses**, forming tiny droplets in clouds. When the clouds meet cool air over land, **precipitation** occurs, and water returns to the land (or sea) in the form of rain, snow and hail. Some of the precipitation soaks into the ground. (Infiltration)

Infiltration

Some of the underground water is trapped between rock or clay layers; this is called groundwater. But most of the water flows downhill as **runoff** (above ground or underground), eventually returning to the seas as slightly salty water.

How important is water cycle to all living things on earth?

Water cycle is one of the most important natural cycles that sustains life on earth. It involves the exchange of heat, which leads to temperature changes. For instance, when water evaporates, it takes up energy from its surroundings and cools the environment. When it condenses, it releases energy and warms the environment. These heat exchanges influence climate.

By transferring water from one reservoir (stored water) to another, the water cycle purifies water, replenishes the land with freshwater, and transports minerals to different parts of the globe.

It is also involved in reshaping the geological features of the earth, through such processes as erosion. Finally, the water cycle is important in the maintenance of life on earth.



Summary

You have come to the end of lesson 9. In this lesson you have learnt that:

- water cycle is the continuous movement of water on, above and below the surface of the earth.
- it involves six processes which include evaporation, transpiration, condensation, precipitation, runoff and infiltration.
- water cycle plays an important role in sustaining life on earth by;
 - regulating the weather which in turn influences the climate.
 - purifying and replenishing the land with fresh water.
- it helps in maintaining the relationship living things have with each other and with their environment.
- water cycle can also reshape the landform through such processes as weathering, erosion and laying down of materials.

NOW DO PRACTICE EXERCISE 9 ON THE NEXT PAGE

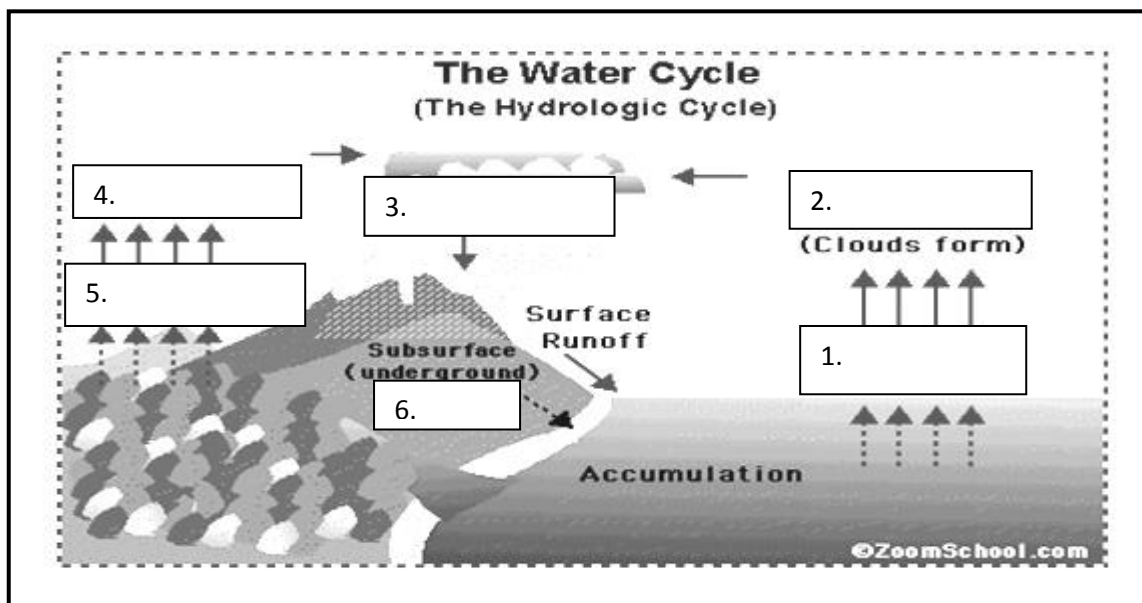


Practice Exercise 9

1. What is water cycle?

2. How many processes are there in the water cycle?

3. Complete the diagram of water cycle below by writing in the correct process in the blank spaces numbered 1-5.



4. How does water cycle sustain life on earth?

5. Through which two processes can water cycle reshape landform?

- i. _____
- ii. _____

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 1

Lesson 10: Islands and Mountains



Welcome to lesson 10. In Lesson 9, you learnt about the water cycle and how water is circulated on the earth's surface. In this lesson, you will learn how continents, islands and mountains are formed.



Your Aims:

- differentiate between continents, islands and mountains
- explain how islands and mountains are formed
- tabulate and list the mountains ranges, the largest islands and their general locations



Continents and mountains seem to be the same to me.

Off course not! They are not the same. There is a difference between a continent and a mountain.



You are probably on a continent right now.



As you have learnt in lesson 7, **continents** are major land masses on the earth.

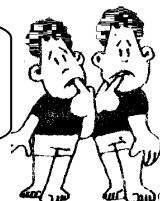
An **Island** is a smaller piece of land with water all around.

Mountains on the other hand, are found where the land rises up steeply to over 300 metres. They are landforms that make up the continents. They are usually bigger with steeper slopes than hills. They have height above sea level to be greater than 1000 metres.

Hills are smaller landforms with height above sea level ranging from 200 to 1000 metres. Usually hills are not as steep as mountains.



I am in Papua New Guinea and it is a Pacific Island country. For this reason, I am on the continent of Australia.



Now which continent are we on?

Yes, I can! You see, these theories try to explain how the current continents and other major landforms were formed?

Can you recall your Grade 7 lesson on **continental drift** and **tectonic plates**?



You must remember that the earth is made up of a number of large land masses called **tectonic plates**.

Some of these land masses have extended beneath the sea. Those beneath the sea are called the **oceanic plates**. Those land masses that project high above the land surface are the continents and mountains.

These tectonic plates are floating on the liquid asthenosphere which is in the upper layer of the mantle. Hence, they are constantly moving. Sometimes these plates collide or converge.

The boundaries of the converging plates are very destructive zones where major landforms such as mountains are formed.

When mountains are connected together they form mountain chains or ranges. Mountains generally are understood to be larger than hills.

The Central Cordillera and the Owen Stanley Ranges are examples of mountain chains in Papua New Guinea. All the continents that you have seen earlier have some mountain ranges.

When mountain ranges are linked together, it makes a **mountain belt**. A mountain belt is many tens to hundreds of kilometres wide and hundreds to thousands of kilometres long.

It stands above the surrounding surface, which usually lies near sea level. Mountain ranges or chains extend tens to hundreds of kilometres in length.



Owen Stanley Ranges in Papua New Guinea

The major mountain forming forces are the **tectonic plate movements** which cause plates to collide.

When molten rock reaches the earth's surface due to these tectonic plate movements, they form volcanic mountains. For example, the Andes mountain ranges in South America are volcanic mountains.

Some mountains are carved out **by erosion**. Wind and water wear away soil and soft rock. The hard rock stays and becomes mountains. The Ozark Mountains in Arkansas and Missouri in USA were made by erosion.

The low places between mountains in a range are called **valleys**.

The Highest Mountain on each Continent				
Continent	Mountain	Location	feet	meters
Asia	Mount Everest	China-Nepal	29,035	8,850
South America	Aconcagua	Argentina	22,834	6,960
North America	Mount McKinley	United States	20,320	6,194
Africa	Kilimanjaro	Tanzania	19,341	5,895
Europe	Mount Elbrus	Russia	18,510	5,642
Antarctica	Vinson Massif	Antarctica	16,066	4,897
Australia and the Pacific Islands	Mount Wilhelm	Papua New Guinea	14,793	4,509

Looking at Islands

As mentioned in the beginning of this lesson, islands are smaller land masses than continents. An island is an area of land surrounded entirely by water.

If you look carefully at the map of the world, you will find that everywhere is an island: all the land on earth surrounded by water.

However, when we talk about islands we are referring to small areas of land surrounded by water. We often call New Guinea an island. This refers to the mainland of Papua New Guinea and Irian Jaya. Examples of islands in Papua New Guinea are New Britain, Karkar, Goodenough and Manus.

The Pacific Ocean has more than 30,000 islands. The Hawaiian Islands are probably the biggest and best known of these.

Map of Hawaii Showing the Chain of Islands



How Islands Were Formed?

There are two basic ways by which islands are formed.

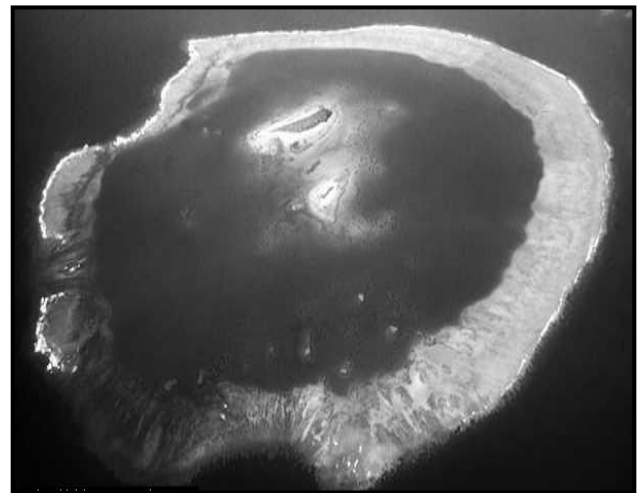
Firstly, the sea level can rise so that parts of what was the mainland are made into islands. In Grade 7 you learnt about Global Warming and Climate Change.

This warming has caused polar ice caps and ice on the highest mountain tops to melt. All these water end up at the sea. This causes the sea level to rise. The islands formed in this manner are called **drowned islands**.

Secondly, the land can rise above sea level. There are four ways in which this is happening:

- (i) The land may be lifted up by tectonic plate movements. Islands formed in this way are called **uplifted islands**.
- (ii) **Volcanic islands** are formed when volcanoes rise from the sea floor until they appear above the surface of the sea.
- (iii) The **raised coral reef islands** are formed when coral reefs grow near the sea level in order to compete for sunlight. **Atolls** are special type of islands formed when coral reefs grow in circle.
- (iv) Finally, we have the **depositional islands** formed from deposits of debris from a rivers load as it enters the sea. For example, Daru islands formed by the deposits from Fly River.

An Example of a Coral Reef and an Atoll



Ten Largest Islands in the World

Island	Area in Square Kilometres
Greenland	2 175 600
New Guinea	792 500
Borneo	725 500
Madagascar	587 000
Baffin	507 500
Sumatra	427 300
Honshu	227 400
Great Britain	218 100
Victoria	217 300
Ellesmere	196 200

**Summary**

You have come to the end of lesson 10. In this lesson you have learnt that:

- continents are major land masses on the earth.
- there are seven major continents on the earth: Africa, Australia, Antarctica, North and South America, Asia and Europe.
- continental shelf is an area of shallow waters and they extend along the coastlines of the continents bordering the Pacific.
- mountains generally are found where the land rises up steeply to over 300 meters.
- when mountains are connected together, they form mountain chains or ranges.
- the low places between mountains in a range are called valleys.
- mount Wilhelm in Papua new is the highest mountain in the Australia, pacific regions.
- an island is an area of land surrounded entirely by water.
- there are more islands in the pacific than in all other oceans.
- islands are formed by two ways: when sea level rise causing parts of mainland to be made islands and when land rise above sea level.

NOW DO PRACTICE EXERCISE 10 ON THE NEXT PAGE



Practice Exercise 10

1. Distinguish between continents, mountains and islands?

2. What is the height of the highest mountain in the world and where is it located?

3. By how many metres is Mt Wilhelm lower than the highest mountain in the world?

4. Islands that are formed by sea level rise which covers some parts of the mainland are called _____.

5. List the four types of islands that are caused by land rising above the sea level.

(i) _____

(i) _____

(ii) _____

(iii) _____

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 1
--

Lesson 11: Grasslands and Desert Vegetation



Welcome to lesson 11. In the last lesson, we looked at continents, mountains and islands. In this lesson, we will study grassland and desert vegetation.



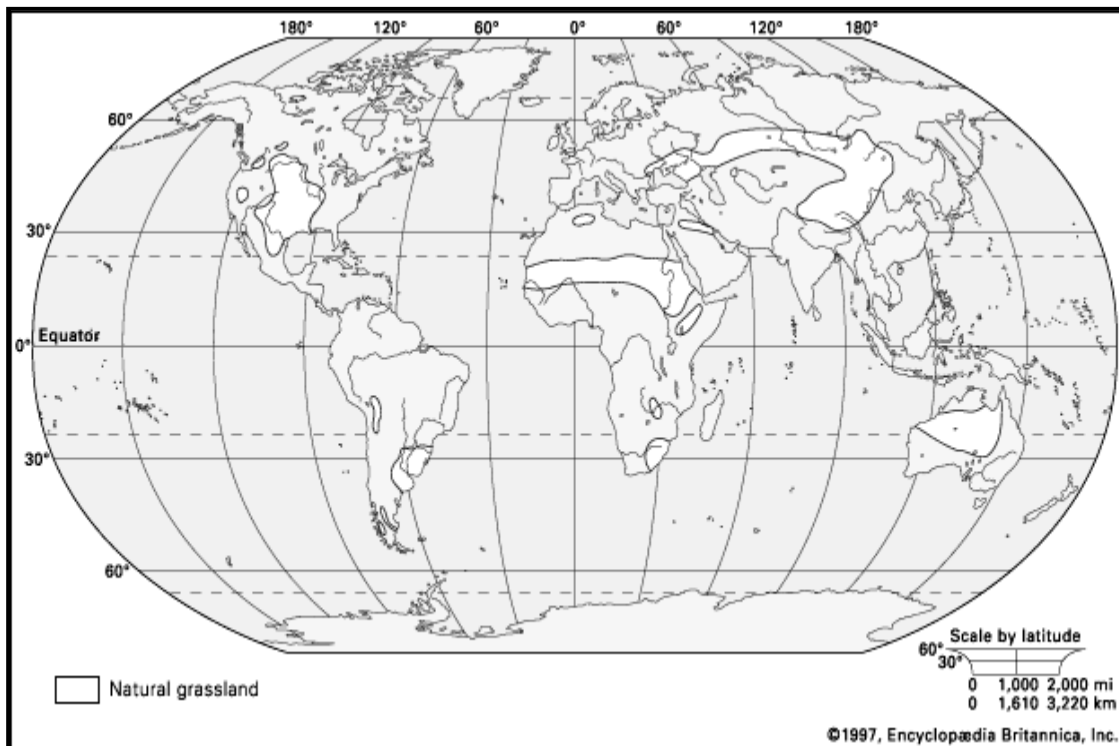
Your Aims:

- define grasslands and desert vegetation
- identify and describes the types of grasslands and desert vegetation
- show the distribution of grassland and desert vegetation areas on a map
- describe the climatic factors that influence these vegetation distribution
- discuss the characteristics of grassland and desert vegetation

What are Grasslands and Where Do We Find Them?

Grassland is an area in which the vegetation is dominated by a nearly continuous cover of **grasses**. Grasses are any of many low, green, non-woody plants. Grasslands occur in environments conducive to the growth of this plant cover but not to that of taller plants, particularly trees and shrubs.

Distribution of Natural Grasslands



Grasslands are one of the most widespread of all the major vegetation types of the world. This is so, however, only because human manipulation of the land has significantly changed the natural vegetation.

The two main types of natural grasslands in the world are the **tall tropical grasslands** and the **short temperate grasslands**.

(i) Tall Tropical Grasslands

These are located mainly in the tropical latitudes. They occur on the western sides of continents and the interior of tropical and temperate continents. Although tall grasses form the dominant plant life of these regions, trees are common near water courses and in the more humid areas.



Palm savannah in central Gran Chaco, Argentina

Have anyone of you been to Port Moresby?



Areas around Port Moresby have very well developed natural distribution of savannah grasslands.



Savannah Grassland in Port Moresby

Wet savannahs have a dry season that lasts less than half the year, between three and five months.

These ecosystems tend to have more trees dispersed throughout than systems with longer periods of dryness.

Typical wet savannahs are found close to rainforests in Asia and tropical America.

The grasses are usually two metres high or more and they grow in compact tuff.

Their long roots can reach down deeper into the soil to extract water.

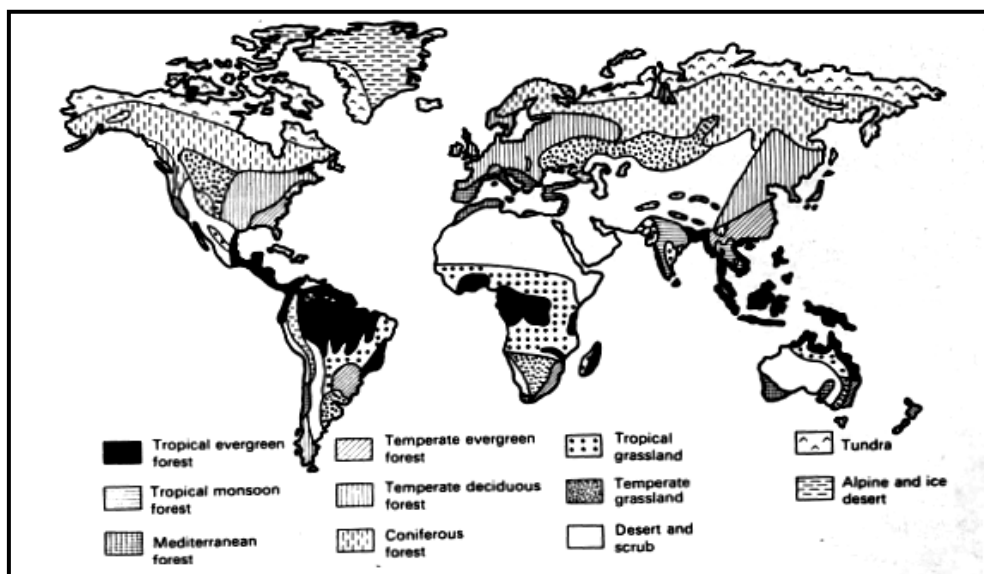
During the dry season the leaves of the grasses turn yellow and die but the roots remain **dormant** (sleeping). These grasses are **deciduous**.

Deciduous means (shedding) falling off, of leaves annually or for a period of time

The trees of these regions are also deciduous. Their leaves fall off in the dry season. Some trees like the baobabs and bottle trees, store water in their swollen trunks and in this way they are able to survive the dry season.

Generally, these grasslands merge with the hot deserts and the vegetation changes greatly. Instead of a continuous vegetation cover, clumps of scrub-like plants are dispersed on the surface.

Global Distribution of Natural Vegetation



Tropical grasslands are given different names according to their location or regions in which they occur. For example in Brazil they call it campos, Llanos in Guiana Highlands while in Africa and Australia they call it savannah. In Papua New Guinea we also call it savannah.

(ii) Temperate Grasslands

These are best developed in the center of continents in the temperate latitudes. For example, in the heart of Asia and North America. Some of these grasslands occur in South America, South Africa and Australia. These grasslands are shorter than the tropical grasslands.

These grasslands are almost treeless. In rainy areas, the grasses are tall as those of the tropical grasslands and very nutritious. The soils under the temperate grasslands are very fertile.

These grasses have also developed adaptations to survive during the winter and summer seasons. Few trees grow in areas with little water. Like the tropical grasslands they have their regional names.

In Eurasia it is called steppes, prairies of North America, pampas of Argentina, South African veldt and the downs of Australia.

These grassland areas have the richest fertile soils in the world. Due to the soil fertility of these areas they are extensively cultivated areas in the world.

Desert Vegetation

Deserts are very dry, hot or cold environments. The hot tropical deserts are within the interior of continents in the tropics while the cold temperate deserts occur within the deserts in the interior of continents in the temperate latitudes.

Examples of some plants of the desert vegetation

Organ Pipe cactus



Prickly Pear Cactus



Barrel Cactus

Most parts of tropical deserts have plants that are specifically adapted to withstand high temperatures and long periods of dry seasons. The plants also withstand extreme droughts. They grow long roots; others have few or no leaves at all. Others have tough, waxy or needle-shaped leaves to reduce transpiration. Cacti is a common desert plant.

**Activity**

What is the main difference between tropical and temperate grasslands?



Summary

You have come to the end of lesson 11. In this lesson you have learnt that:

- grassland is an area in which the vegetation is dominated by a nearly continuous cover of grasses.
- the two main types of natural grasslands in the world are the tall tropical grasslands and the short temperate grasslands.
- deciduous means shedding leaves annually or for a period of time.
- areas around Port Moresby have very well developed natural distribution of savannah grasslands.
- tropical grasslands are given different names according to their location or regions in which they occur.
- these are best developed in the interior of continents in the temperate latitudes.
- deserts are very dry, hot or cold environments.

Answer to Activity

The tropical grasslands are hotter while temperate grasslands are shorter / the soils under the temperate grasslands are more fertile than that under the tropical grasslands.

NOW DO PRACTICE EXERCISE 11 ON THE NEXT PAGE



Practice Exercise 11

Refer to the world map showing the distribution of natural vegetation in the lesson to answer Question 1.

1. Describe the distribution of temperate and tropical grasslands, including their location and factors that affect their distribution pattern.

2. List three ways by which tropical desert plants adapt to their climate.

- (i) _____
- (ii) _____
- (iii) _____

3. Names for temperate grasslands in Australia is _____ while in South Africa is _____.

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 1
--

Lesson 12: Forests



Welcome to lesson 12. In the last lesson you learnt that grasslands and deserts occur in areas of little or no rainfall. In this lesson, we will study the occurrence and distribution of forests. This vegetation occurs in areas of high rainfall.



Your Aims:

- define forest
 - identify the different types of forests
 - identify the importance and usefulness of forests
 - show the distribution of forests on the global scale
 - describe the distribution of forests and the climatic factors that influence it
 - discuss the effect of man's impact on forests
-

What are Forests?

Forests are large areas covered thickly with trees and plants. There are a lot of trees growing together. Trees are woody plants that renew its growth every year.

Most plants classified as trees have a single self-supporting trunk containing woody tissues. In most species the trunk produces secondary limbs, called **branches**.

Tree dominated forests can occur wherever the temperatures rise above 10° C in the warmest months and the annual precipitation is more than 200 millimetres.

They can develop under a variety of conditions within these climatic limits. The kind of soil, plant and animal life differs according to the extremes of environmental influences.

In **cool, high-latitude sub-polar regions**, forests are dominated by hardy **conifers** like pines, spruces, and larches. These taiga (boreal) forests have prolonged winters and between 250 and 500 millimetres of rainfall annually.

In more **temperate high-latitude** climates, mixed forests of both **conifers and broad-leaved deciduous** trees predominate.

Broad-leaved deciduous forests develop in middle-latitude climates, where there is an average temperature above 10° C for at least six months every year and annual precipitation is above 400 millimetres.

Below are examples of broad leaf deciduous trees in the middle latitudes



An Oak Tree



A Sugar Maple Tree

Types of Forests and Where They Occur

A number of forest types are recognised globally. Within the tropical regions there exist tropical evergreen rainforests and tropical monsoon.

In the temperate regions, there are temperate evergreen forests, temperate deciduous broadleaf forests and the coniferous evergreen forests.



Part of a tropical rainforest



Tropical Rainforest Canopy



Lianas in a tropical rainforest



A Village in a Monsoon Forests

A rainforest is a place where there is lots of rain. One kind of rainforest is called a temperate rainforest. You can find temperate rain forests where the weather is cool and mild and very wet.

A **temperate rainforest** grows near the Northwest coast of the United States. Just a few kinds of evergreen trees grow there. Most of the world's rainforests are tropical rainforests with many kinds of trees.

Tropical rainforests grow in warm places near earth's equator. The equator is an imaginary line that goes around the middle of the planet.

There are tropical rainforests in Central and South America, Africa and Asia. The world's largest rainforest is the Amazon rain forest in South America. It is always hot and wet in a tropical rainforest.

A 'rainforest' is a forest that receives a lot of rainfall all year round

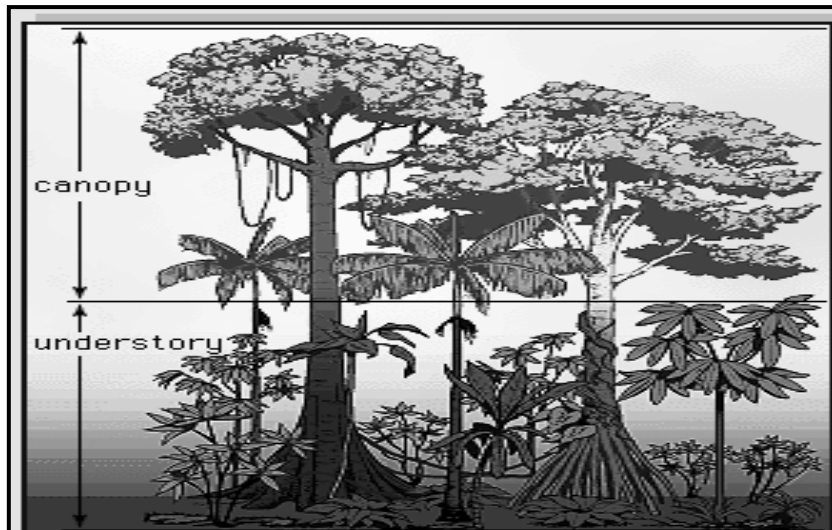
Biological Diversity in Tropical Rainforest

Where would you go to find more kinds of plants and animals than anywhere else on earth? You would go to a tropical rainforest. Tropical rainforests are home to an amazing number of plants and animals.

The word **biodiversity** is used to describe this great variety of plants and animals. A patch of tropical rainforest no bigger than a school parking lot can have almost as many different *species* (kinds) of trees as there are in all the forests of Canada and the United States.

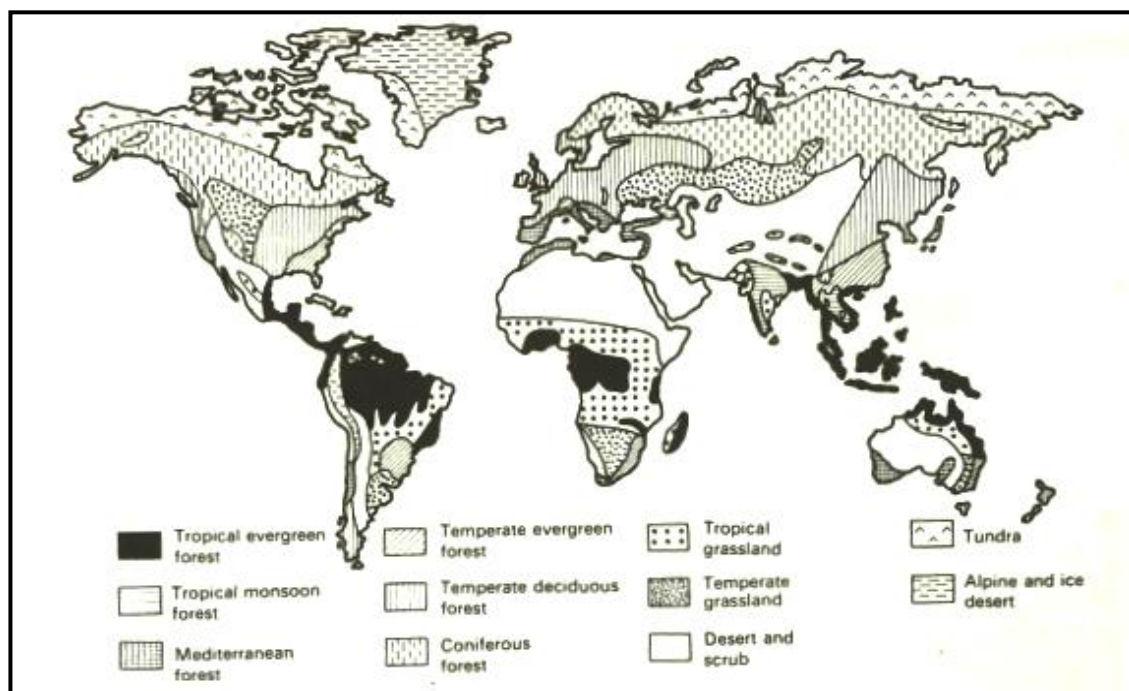
Biologists believe that more than half of the world's plant and animal species live in tropical rainforests.

Profile of a Tropical Rainforest



Now, take a look at the map below. It shows the general distribution of all natural forests around the world. Although, Papua New Guinea is generally classified as a tropical rainforest country, there are many other different types of vegetation.

Global Distribution of Natural Vegetation



What is happening to the World's Forests?

Forest has always played an important role in the lives of indigenous or native population in forest communities. People who live in the forest find food, clothes, building materials, medicine and just about everything they need comes from it.

It is an important carbon sink. Large areas of forest absorb a lot of carbon dioxide that is usually released from the burning of fossil fuels. This help reduces the effect of global warming and climate change.

Forests also regulate climate in terms of the huge amounts of vapour they release to maintain the water cycle processes.

Tropical rainforests today represent a treasure of biological heritage. They not only retain many primitive plant and animal species but also are communities of biodiversity and a great variety of ecological interactions.

The tropical rainforest of Africa was the habitat in which the ancestors of humans evolved, and it is where the nearest surviving human relatives called **chimpanzees** and **gorillas** live still.

Tropical rainforests supplied a rich variety of food and other resources to indigenous peoples, who, for the most part, exploited this bounty without degrading the vegetation or reducing its range to any significant degree.

However, in some regions a long history of forest burning by the inhabitants is thought to have caused extensive replacement of tropical rainforest and tropical deciduous forest with savanna.

The process of widespread destruction of forests is called **deforestation**. Tropical rainforests and tropical deciduous forests are now being destroyed at a rapid rate in order to provide resources such as timber and to create land that can be used for purposes such as cattle grazing and urban development.

As population of indigenous forest communities increases, the demand for making more gardens increases. Therefore, more forest is now being removed.

Today tropical forests, more than any other ecosystem, are experiencing habitat alteration and species extinction on a greater scale and at a more rapid pace than at any time in their history.

Images of Rain Forest Destruction



Huge areas of the world's rainforests are cut down every year. The area shown above used to be part of the Amazon rainforest in Brazil. Scientists fear that many kinds of animals and plants are becoming extinct because of this destruction.



Summary

You have come to the end of lesson 12. In this lesson you have learnt that:

- forests are large areas covered thickly with trees and plants.
- a rainforest is a place where there is lots of rain.
- tree-dominated forests can occur wherever the temperatures rise above 10° c in the warmest months and the annual precipitation is more than 200 millimetres.
- in cool, high-latitude sub-polar regions, forests are dominated by hardy conifers like pines, spruces, and larches.
- in more temperate high-latitude climates, mixed forests of both conifers and broad-leaved deciduous trees predominate.
- biodiversity refers to a great variety of plants and animals.
- biologists believe that more than half of the world's plant and animal species live in tropical rainforests.
- forests provide food, clothes, building materials and medicine for people who live there.
- tropical rainforests and tropical deciduous forests are now being destroyed at a rapid rate in order to provide resources such as timber and to create land that can be used for cattle grazing and urban development.
- the process of widespread destruction of forests is called deforestation.

NOW ANSWER PRACTICE EXERCISE 12 ON THE NEXT PAGE



Practice Exercise 12

1. Define forest?

2. List the two types of tropical forest.

- (i) _____
- (ii) _____

3. What is biodiversity?

4. In what type of climatic conditions would you expect to find hardy **conifers** like pines, spruces and larches?

5. List four causes of widespread deforestation in the world today.

- (i) _____
- (ii) _____
- (iii) _____
- (iv) _____

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 1

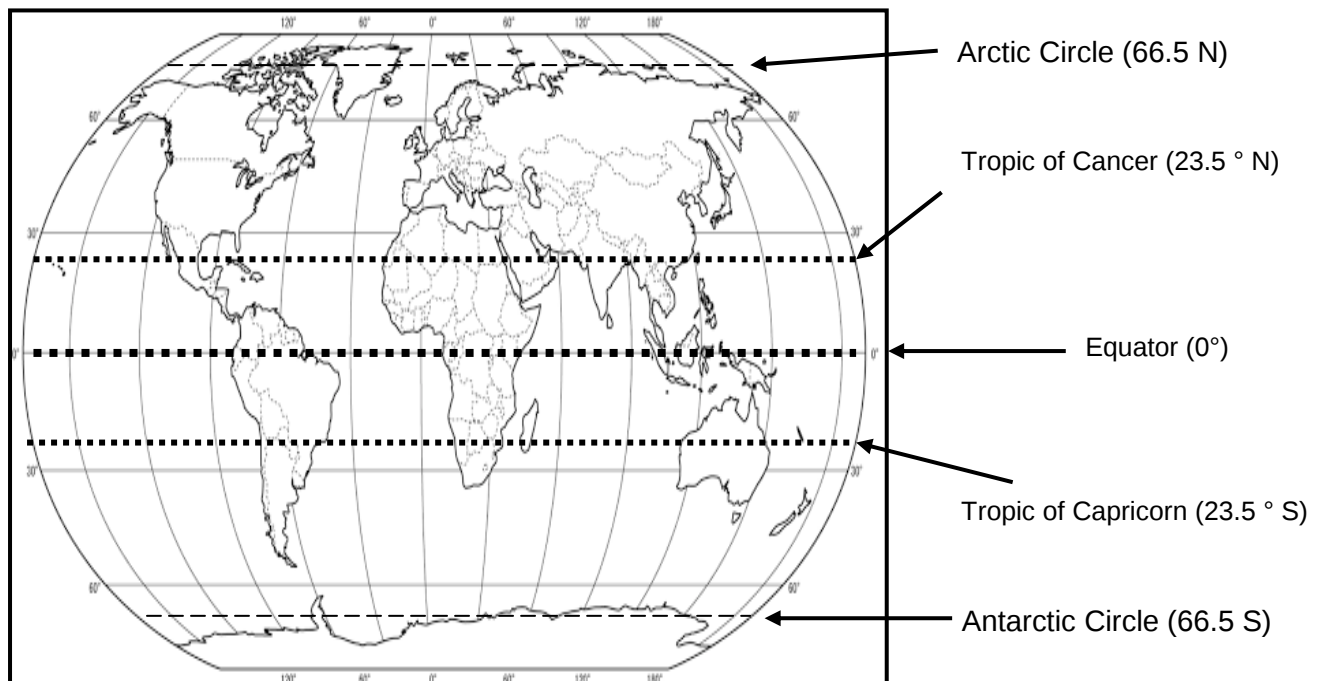
SUB-STRAND 1**ANSWERS TO PRACTICE EXERCISES 1-12**

Practice Exercise 1

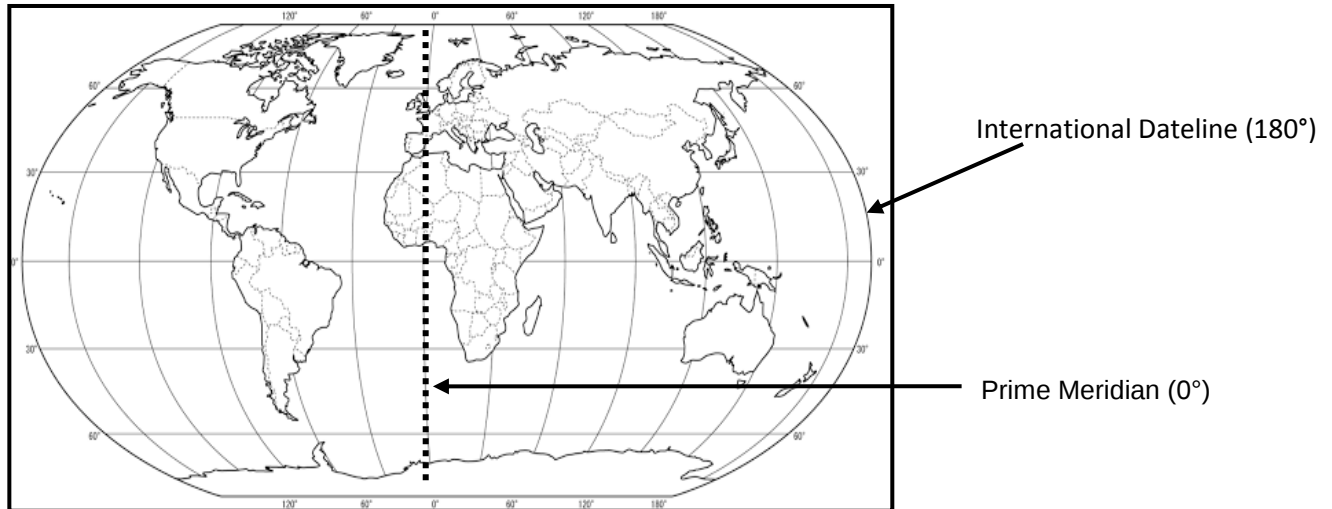
1. The features of the natural environment refers to the natural things in the different zones of the earth such as ; mountains, plants and animals.
 2. The two broad divisions of the physical world are;
 - i) the living world (Biotic Environment)
 - ii) the non-living world (Abiotic Environment)
 3. The Biotic environment (Biosphere) is the zone of life.
 4. Divisions of the Abiotic environment are;
 - i) atmosphere (zone of air)
 - ii) hydrosphere (zone of water)
 - iii) lithosphere (zone of rock and land)
 5. The land, water and atmosphere work together to regulate the climate.
 6. Plate movements
 7. Weathering, erosion and deposition processes re-shape the land.
-

Practice Exercise 2

1.



2.



3. Difference in time

- i) Sunday in Samoa
- ii) Thursday
- iii) Thursday

Practice Exercise 3

1. Matching

- i) Point F ii) Point A iii) Point H iv) Point D

2. Point B is located right on the Prime Meridian and 80°N

3. Coordinates

- i) 40°N, 100°W ii) 10°S, 40°W iii) 40°N, 60°E

Practice Exercise 4

1. Average temperature and rainfall

2. Weather is the short term changes in the atmospheric conditions usually on a daily basis, while climate refers to the long term changes in atmospheric condition in a particular place.

3. A. Tropical B. Sub-tropical C. Temperate D. Polar

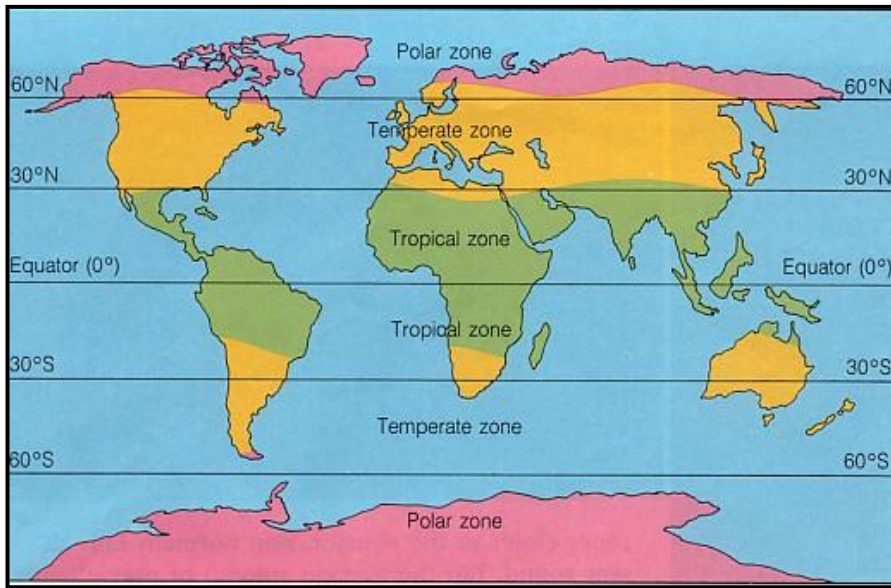
4. Angle of the sun, rotation of the earth, altitude, distance from the sea, air movement, precipitation and monsoon winds

5. Spring, summer, autumn and winter

6. Summer in Asia and winter in Australia

Practice Exercise 5

1. Climatic regions of the world.



Your labelling of the map should look like this.

It should clearly show the climatic zones. The latitudes must have been clearly written.

Different colours should have been used.

2. Climate zones and their seasons

Climate zone	Characteristics/Seasons
Polar	Cold and icy all year round
Temperate	Cold winters and mild summers
Sub-tropical	Often dry in desert areas
Tropical	Hot and wet all year round

Practice Exercise 6

- Air moves from areas of **high** pressure to areas of **low** pressure.
- The difference in pressure between two points.
- Wind is created by differences between hot and cold air.
- from the south east
- (i) North west winds (ii) Wet and rainy seasons
(iii) Hot and distinct dry seasons

Practice Exercise 7

1. Five countries each (*any five countries of each continent*).

Asia	Africa	North America	South America	Europe	Oceania
China	South Africa	Canada	Brazil	United Kingdom	New Zealand
Japan	Zambia	USA	Bolivia	Denmark	Australia
India	Kenya	Mexico	Peru	Poland	Fiji
Pakistan	Nigeria	Jamaica	Argentina	France	Papua New Guinea
Taiwan	Somalia	Costa Rica	Chile	Spain	Solomon Islands

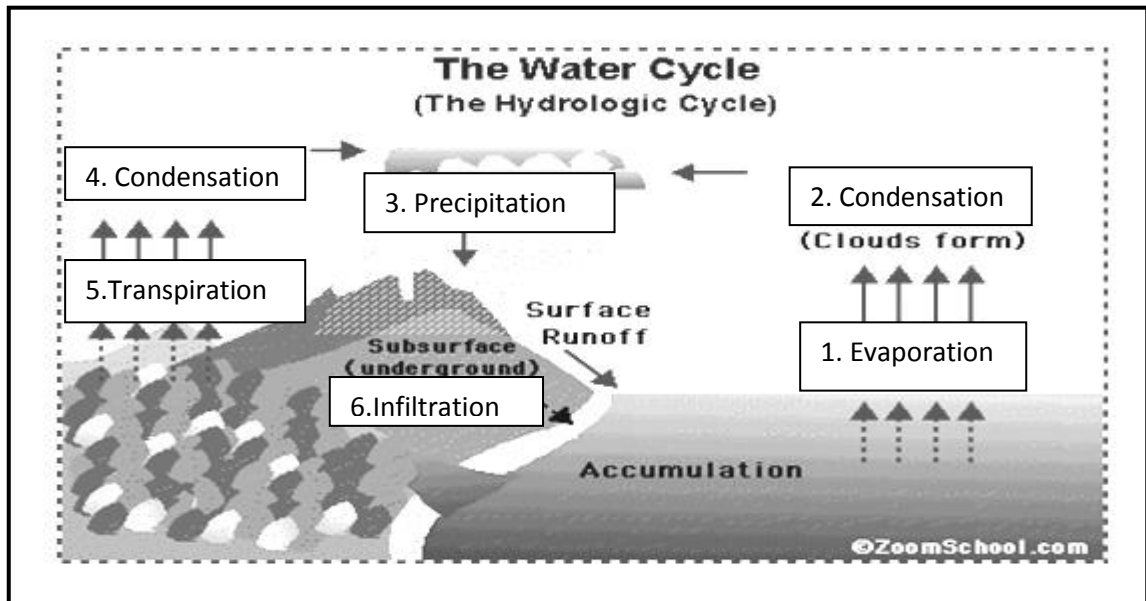
2. The continents were formed as a result of the earth's movement. Large pieces of land masses called tectonic plates move. Their movement create different landforms, which eventually form continents.
3. It creates different types of landforms, causes earthquakes, tsunami and volcanoes.
-

Practice Exercise 8

- Pacific
 - Arctic Ocean
 - Pacific Ocean
 - Because they influence the weather and the distribution of sea life.
 - Any two of those given; i) Gulf Stream ii) North Pacific Drift
 - Any two uses of rivers i) Irrigation ii) Producing Electricity
 - The Amazon River in Brazil
-

Practice Exercise 9

1. The continuous movement of water on, above and below the earth's surface.
2. Six processes
- 3.



4. Regulates water which influences climate
Purifying and replenishing the land with fresh water
5. i) weathering ii) erosion iii) deposition

Practice Exercise 10

1. Continents are large landmasses while mountains are found where the land rises up steeply to over 300 metres. Islands are areas of land that are completely surrounded by water.
2. Mt Everest is 8850m above sea level and is located between China and Nepal.
3. Mt Wilhelm is 4341m lower than Mt Everest ($8850 - 4509 = 4341$).
4. Islands that are formed by sea level rise which covers some parts of the mainland are called **drowned islands**.
5. Types of islands;

i) Uplifted Islands	ii) Volcanic Islands
iii) Raised Coral Reef Islands	iv) Depositional Islands

Practice Exercise 11

1. According to the map, temperate grasslands are found in the interior of Russia and USA. Some patches of these grasslands are on the south eastern coast of South America and South Africa. Smaller patches are found in the Murray Darling floodplains of Australia.
 2. Ways of adapting;
 - (i) Growing long roots to search for water underground
 - (ii) Growing hard, waxy, needle shape leaves to reduce water loss by transpiration
 - (iii) Some plants have no leaves at all
 3. The temperate grasslands in Australia are called **Downs** while in South Africa it is called **Veldt**.
-

PRACTICE EXERCISE 12

1. Forests are large areas covered thickly with trees and plants.
 2. Types of tropical forest;
 - (i) Tropical Rainforests
 - (ii) Tropical Monsoon Forests
 3. The word **biodiversity** is used to describe a great variety of plants and animals.
 4. in cool, high-latitude sub-polar regions
 5. Causes of deforestation;
 - i) Commercial Logging
 - ii) Agricultural Farmland
 - iii) Shifting cultivation by indigenous forest communities
 - iv) Mining
-

SUB-STRAND 2

INFLUENCES OF PHYSICAL ENVIRONMENT ON HUMAN SETTLEMENT PATTERNS

In this sub-strand you will learn about:

- **Human Environment**
- **Human Settlement Patterns**
- **Adapting to the Physical Environment**
- **Settling the World**
- **World Population**
- **Population, Maps and Graphs**
- **Urbanisation**
- **Urbanisation' A Comparative Study**

SUB-STRAND 2: INTRODUCTION

Influences of Physical Environment On Human Settlement Patterns

In this sub-strand, you will learn about man-made environments such as settlements and settlement patterns. You will study how people settle in different places and are able to fit themselves to the physical environment.

With this, you will also study the world population and the maps and graphs which represent figures of the population.

You will look at urbanization and a case study which gives you a clear understanding of the process of urbanisation.

Lesson 13: Human Environment



Welcome to Lesson 13 of sub-strand 2. In the previous lessons, you studied aspects of the natural or physical environment. In this lesson, you will be looking at what the human environment is made up of.



Your Aims:

- review the meaning of human environment
 - identify the key features of the human environment
 - study the similarities and differences between two countries within the same region
-

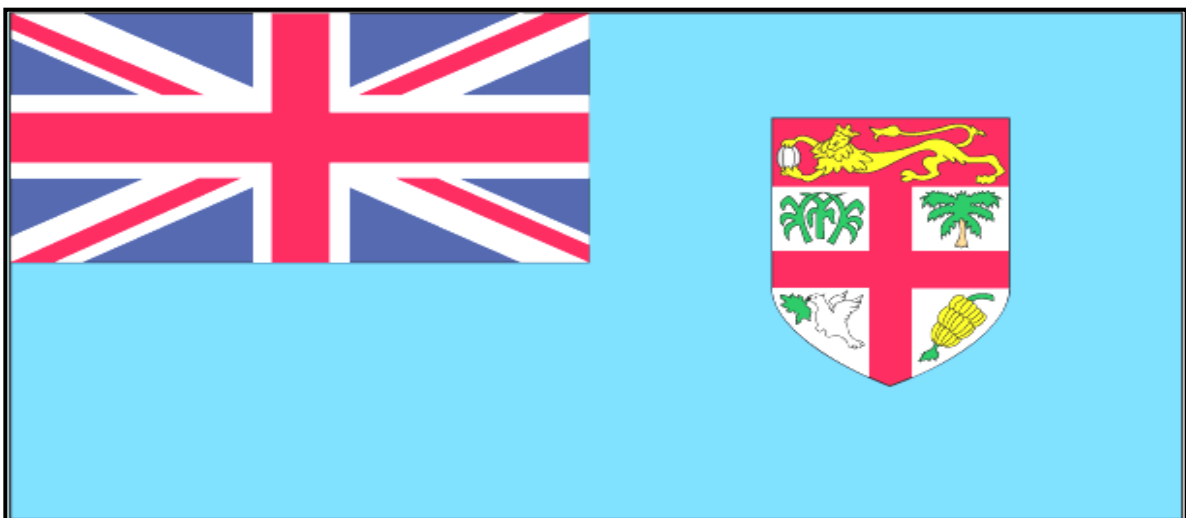
Can you recall what the human environment is? You learnt this in your Grade 7. It is part of the environment that is influenced by humans. The cities, towns, sports field, a plantation of coconut trees and a school are all examples of environments created by man.

Much of what you will learn next is based on describing the similarities and differences between Papua New Guinea and Fiji. These two countries are located within the South Pacific Region. They have a lot of similarities and differences in terms of the human aspects such as language, characteristics of their cities and culture.

Fiji and Its Human Environment

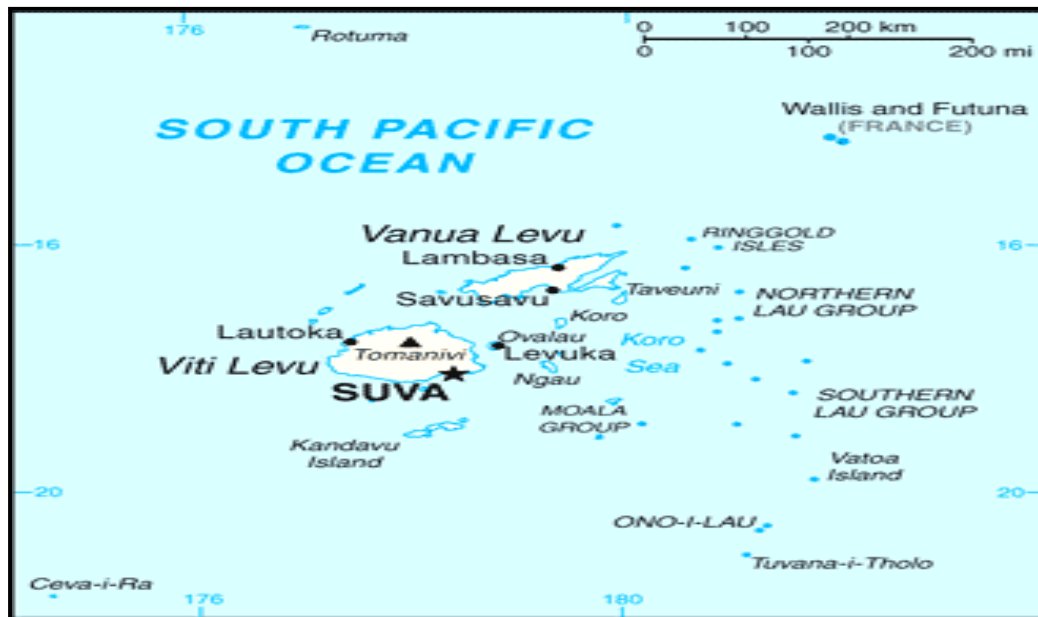
Fiji is officially the Sovereign Democratic Republic of Fiji, referred to as the Fijian Viti. The capital of Fiji is Suva, and is located on the south east coast of the largest island Viti Levu which is commonly described as 'Great Fiji'.

Flag of Fiji



The national flag consists of a light blue field (background) bearing a Union Jack in the canton shield of the national coat of arms at the fly end.

Map of Fiji



Fiji shares border with Rotuma, an island of 18 square mile located about 400 miles north-northwest of Suva. Rotuma has a Polynesian population and was administered by Fiji in colonial times.

The People

The indigenous Fijian people are usually classified as Melanesians, but their physical appearance differs from Melanesians of Vanuatu, Solomon Islands or New Guinea. Their social and political organization is similar to that of Polynesians.

There has been a high rate of inter-marriages between Fijians from Lau Islands of eastern Fiji and the neighboring Polynesia Islands of Tonga. The main religion in Fiji is Christianity, mostly Methodist and Roman Catholic.

The arrival of Indians after World War II, meant more Indians than indigenous Fijians. These Indians are the descendants of indentured labourers brought to work in the sugar industry by the British.



These Indentured labourers working in Sugar-Cane Fields



them, many of these are sugar-cane farmer settlements

What do you think will happen to Papua New Guinea in the future, if we allow a lot of freedom of religion?

Like Papua New Guinea, English is the official language. Another commonly used lingual is Bauan Fijian and comes from Bau. Most people speak at least two languages, including English and their local language.

Intermarriage between races is not common in Fiji. Although, there are mix populations in Suva, the sugar regions have more Indians than Fijians. The Fijians live in traditional villages in smaller islands and in the less developed rural areas of the big islands. Today, many people live in wooden or hurricane houses. Fiji is frequently hit by hurricanes so people have built stronger houses made of bricks.



Kadavu Island – Thatched Houses

A bure is a traditional home. It has a wooden framed circular, a rectangular cottage with thatched roofs and woven flax walls.

Economy

Fiji, like most other developing countries in the world has an agricultural based market economy, including a subsistence sector dominated by indigenous Fijians who earn extra cash income from cash crops such as copra, cocoa, kava and fishing. Tourism is the largest earned foreign exchange, as sugar. Gold is mined in northern Viti Levu. Fiji imports more fuel and other manufactured goods are also imported.

Government and Education

Fiji was a member of the commonwealth and a parliamentary democracy, until the change in May, 1987. The change was that Fiji was dismissed from the Commonwealth of Nations due to the coup it undertook in 1987. From 1987, it left the Commonwealth and became a Republic.

While the government provides some primary and secondary education, most schools are controlled through local communities run by and for a single racial or religious community. Entry to secondary schools and universities is by competitive examinations.

The government subsidises some of their fees while students pay the rest. The universities of South Pacific in Suva are regional institutions. Fiji and other Pacific Island governments fund the costs of running the universities.

Interestingly, they too have a distance mode of delivering lessons at a distance. They use satellite network. Fiji provides for its technical, agricultural and medical education and teacher training.

Urbanisation

Many Fijians have migrated to live in urban areas. These people ended up in squatter settlements and have caused a lot of social problems. There are big differences in income, style of life between city and rural dwellers. Like Papua New Guinea, crime rates have increased rapidly.

Cultural Life

Due to the mixed racial backgrounds the cultures are rich. Cultural events include marriage ceremonies, music dance and craft work.

Now we have thoroughly gone through the key features of Fiji's human environment. Let us now have a look at the table below. It highlights some major differences and similarities in the way of life between Papua New Guinea and Fiji.

Similarities and Differences

Country	Similarities	Differences
Papua New Guinea and Fiji	• They both are located within the South Pacific Region. • Both of them are Melanesian ethnic groups. • Like Fiji, Papua New Guinea's main religion is Christianity. • Like Papua New Guinea, English is the language of business and education in Fiji. • Fijians live in rural villages just like the Papua New Guineans. • Fijians experience social problems in towns and cities due to rapid increase in rural-urban drift just like Papua New Guinea. • Fiji is an agricultural based market economy just like Papua New Guinea. • Papua New Guinea has a university just like Fiji's University of South Pacific.	• Fiji is a Democratic Republic, whilst Papua New Guinea is a Parliamentary Democracy. • Papua New Guinea has more than 860 languages while Fiji has very few. • Fiji has two distinct racial groups (Indians and Fijians) while Papua New Guinea has none. • Papua New Guinea's largest revenue earner is the Mining and Petroleum Industry while Fiji's is Tourism and sugar.



Summary

You have come to the end of lesson 13. In this lesson you have learnt that:

- Fiji has moved away from a Parliamentary Democracy to a sovereign Democratic Republic.
- Fiji like Papua New Guinea has social urban problems due to rapid urbanization by rural urban drift.
- as it is with most developing countries, Fiji and Papua New Guinea both are agricultural based market economies.
- Papua New Guinea and Fiji are two important Melanesian countries in terms of economy and status.

NOW DO PRACTICE EXERCISE 13 ON THE NEXT PAGE



Practice Exercise 13

1. Why was Fiji removed from the Commonwealth of Nations?

2. State one lesson Papua New Guinea can learn from your answer in Question 1.

3. List five human features of Fiji that were discussed in the lesson.

(i) _____

(ii) _____

(iii) _____

(v) _____

4. Name the two racial groups that live in Fiji.

(i) _____

(ii) _____

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 2
--

Lesson 14: Human Settlement Patterns



Welcome to Lesson 14. In lesson 13, you identified the similarities and differences between two Pacific countries. In this lesson, you will discuss more about human settlement patterns.



Your Aims:

- explain the meaning of human settlement patterns
 - discuss the key features of human settlement patterns
 - state how history and culture influence settlement patterns
 - study examples of various forms of settlements throughout the world
-

You have learnt in Grade 7 that a settlement is a place where people live. Human settlement is one that has man-made features which are part of the built environment.

Human settlement patterns refer to a concentration (living together in one place) of people according to their ethnic grouping, religious belief and political background. It examines the distribution of human actions across a given location and how these actions are connected to the social and natural environment. It is the way buildings and houses are distributed in an area.

Most people prefer to live in groups or near others in settlements. Settlements as you know, can range from a very small village with only few houses to a very big city with millions of people.

What features affect the human settlement patterns?

People choose to live or settle in an area due to many reasons. Given below are some factors which influence human settlement patterns.

1. Economic and Human Influences

Nowadays, people need money to do everything and anything. They are in-search for money and settle in places where they see that there is a lot of cash flow. People are interested in making a profit and better employment to have a lot of money to live a better life. This desire for money and material goods affect settlement patterns.

2. Physical Influences

The make- up of the landform, soil fertility for gardening and agricultural activities, water and easy access to transport affects settlement patterns. People would like to live in places where they can find all these things mentioned above.

3. Technological Influences

Well established patterns of communication, transportation, markets which are all central motivate people to live in a particular area. More and more people live in such areas.

4. Historical Influences

In some cases, people speaking the same language and similar cultural beliefs in the same area. The historic nature of settlement speaks the specific language and their cultural norms make up a society. This makes it easy for one who shares this to fit in and discouraging strangers. This makes the community united and stronger.

How does history and culture affect human settlement patterns?

As already mentioned, people with similar culture and traditions, and language decide to settle in one place. They fit in very well and interact with each other. This gives them strength and is the way in which man disposes himself over the landscape where he lives, affected and shaped by the environment.

Historically, when people migrated they also moved in groups and settled as an ethnic group in a particular place. Therefore, basically in rural areas you will find that people of the same language and cultural group live in one place.

Papua New Guinea

Archaeological work has been carried out on the island of New Guinea. Current evidence shows that, parts of New Guinea was occupied as early as 50 000 years ago. The presence of pollen planted foods and the remains of swamp-drainage channels and other water management works at Kuk near Mount Hagen indicate the existence of intensive agricultural activity.

The intensity and length of time of human occupation of the highlands was evidence by the agricultural activity mentioned above.

Those discoveries are made even more interesting by the fact that the sweet potato, which is the staple food of the highlands region seems not to have arrived in the area from the Americas until 300 to 400 years ago. It is believed that, taro was the earlier staple food.

Settlement pattern of Papua New Guinea

The great majority of the country's population lives in rural areas. The Southern New Guinea plains are only sparsely populated by relatively mobile sage gatherers. The Highlands valleys are densely (close together) settled, whether in villages or scattered hamlets. The north coast and the northern eastern are generally well-populated, despite the hazards of volcanic eruptions, regular earthquakes and rarely tsunamis. The island of Karkar and the Gazelle Peninsula are densely populated.

The urban population lives for the most part in towns whose original location was determined either by access to a good harbor for early colonial planters or by the availability of level land for an airstrip. Even though, these airstrips and plantations are relocated today, those origins helped determine the layout of large towns such as Port Moresby, Lae and Huon Gulf.

Case study: The Taugregs

People who live in cities are less affected by their natural environment than people who live in rural areas. For example, they are protected from drought by providing water supply. However, some populations of the world are greatly affected by the environment they live in.

For example, the Taugregs do not live in settlements. They are nomads living in the hot desert area of Southern Morocco (north-west Africa). The days are very hot and the nights are very cold. There is not much water and very little vegetation. The

Landscape is flat and stony. They do not grow crops but graze small herds of camels, goats and sheep.

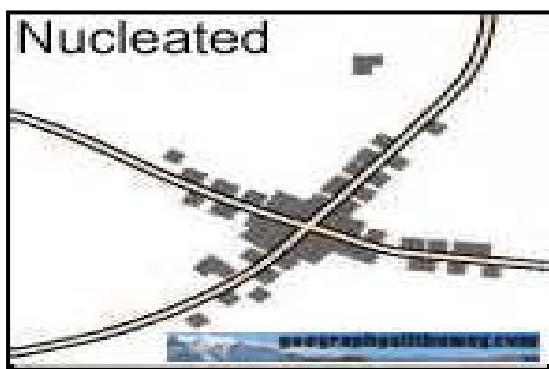
To find enough food for their animals, they have to move three or four times a year to a new place. Their homes are tents which can easily be taken down and moved to the new site. The tents are made of animal and provide protection from strong winds and extremes of temperature. In recent times, animals belonging to the Taugregs have died from drought-affected living conditions. With the loss of their food source and income, many Taugregs have been forced to move into towns to survive.

Types of Human Settlement Patterns

The three common types of human settlement patterns are discussed below.

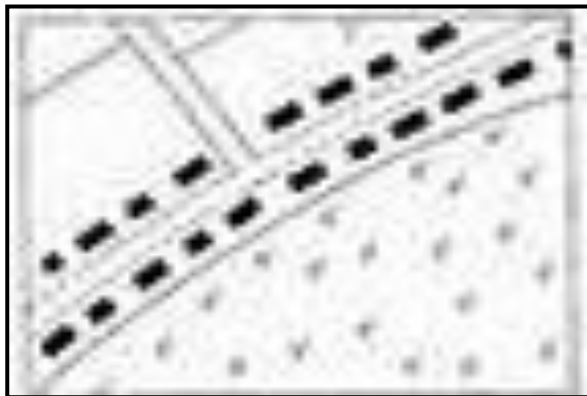
1. Nucleated Settlement Pattern

Buildings are grouped around a central core (in a cluster). See diagrams below.



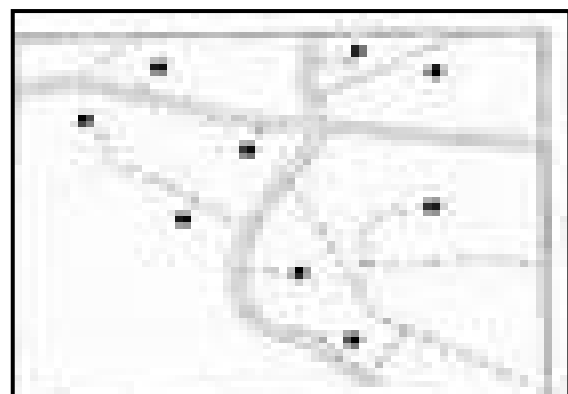
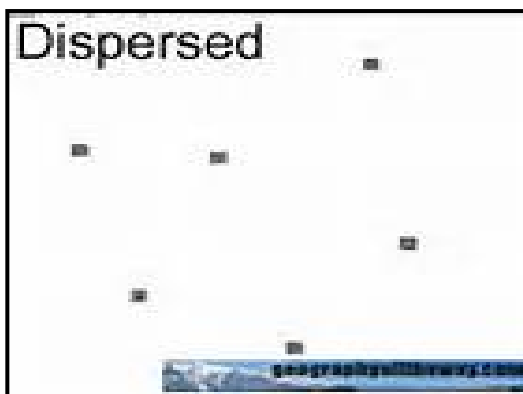
2. Linear Settlement Pattern

Buildings are arranged in lines. These lines follow a route (road) or a body of water (river system). Study the diagrams below.

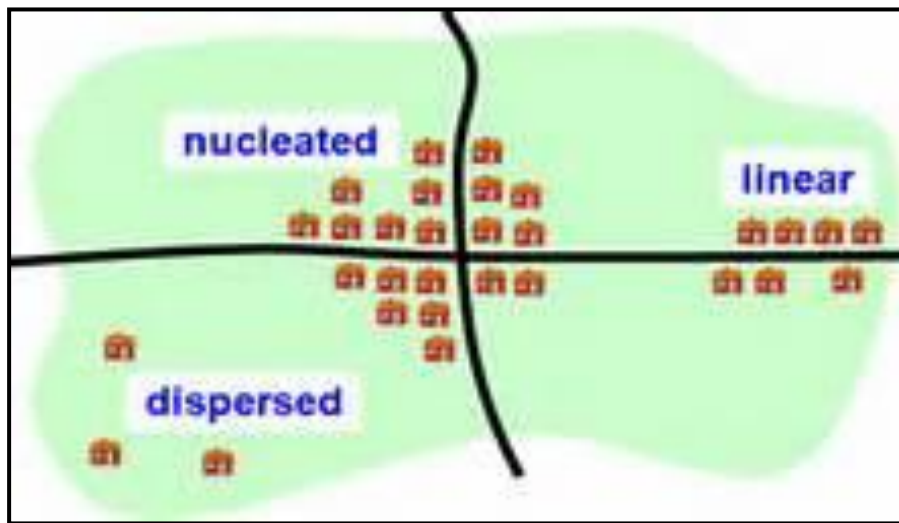


3. Dispersed (Spread out)

Buildings are scattered over a wide area. This type of settlement pattern is often associated with agricultural activity and is surrounded by farmland.



This diagram shows all types of settlement patterns.



Summary

You have come to the end of lesson 14. In this lesson, you have learnt that:

- human settlement patterns refer to the way buildings and houses are distributed in an area.
- features which affect human settlement patterns are; economic and human, physical, technological and historical influences.
- economic influences are settling in an area where there is cash (money) flow with the aim of making a profit.
- physical influences are settling in areas where people have access to water, transport systems, fertile soil for agriculture and suitable climate.
- technological influences when people settle in places where there is better communication, banking, transportation and marketing systems which make life easier for them.
- historical influence is when people speaking the same language and cultural backgrounds living in a particular area.
- a great majority of Papua New Guineans still live in rural areas.
- the rural population of an area is mostly affected by the natural environment than towns and cities.
- the three types of human settlement patterns are; nucleated (cluster), linear (in a line) and dispersed (spread out).

NOW DO PRACTICE EXERCISE 14 ON THE NEXT PAGE



Practice Exercise 14

1. Complete this table. Provide examples of each factor affecting settlement patterns.

Influence/Factor	Example
Economic	
Physical	
Technological	
Historical	

2. Describe how the population of Papua New Guinea is distributed?

3. List and describe the three settlement patterns.

i) _____

ii) _____

iii) _____

4. Draw diagrams of each of the settlement patterns.

CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 2

Lesson 15: Adapting to the Physical Environment



Welcome to Lesson 15. In this lesson, you will learn about how people have adapted to live in harsh and difficult conditions presented by their natural or physical settings.



Your Aims:

- define adaptation
 - make comparison of different places in the world of how people have adapted to the physical environments
 - state the nature of physical environments which influence settlement patterns
-

What is adaptation?

The natural environment always poses challenges for humans who inhabit these places. They have learnt to live in harmony with their environment by adapting to the challenges nature presents.

Adaptation is getting used to the physical condition of the place they live in.

Man has become used to the harsh climatic and top geographical conditions by changing their ways of survival, to live in the natural environment.

Adapting to the physical environment

People have adapted to living in many places on earth over the past 50 000 years.

They live in lowlands at sea level and high altitudes in the mountains. People have adapted to living in deserts with very little water. They live in swamps that are covered by water. People have adapted to living in some of the harshest and most difficult living environments around the world.

People in deserts face dry heat during the day with little moisture. They keep their bodies covered to stop moisture escaping from their bodies. At night, temperatures can be extremely cold.

You can find examples of different environments around the world, and how people have adapted to them. Below are examples of how people have adapted to live in different environment:

- **Thai people** live in a very densely populated environment because much of the country has highly productive soils. Enough food for everyone is important. Rice is the main staple food in the Thai diet.

In Thai culture, it is considered rude to waste even one grain of rice. This disrespects the hard-work of the Thai farmers. It makes people conscious of the need to use their food resources wisely.

- **The Tibetans** live at elevations of 3000 metres in Tibet. They have physically adapted to the low oxygen levels at these altitudes. They have 500 times more red

blood cells than people living at sea level. They have large lung capacity and their bodies produce less lactic acid so that their muscles do not feel so tired when working.



Tibetans at work



A Province of Tibet

In the **Arctic regions**, people need Warm clothing and shelters. Their diet is rich in fats to keep their bodies warm.

In the **humid tropics**, there is plenty of water and plenty of moisture in the air. People wear less clothing and their bodies are adapted to the hot humid climate. Growing populations make finding clean water harder.

In more local examples of adaptations by people who live in their physical setting, you consider the **Highlands of Papua New Guinea**. People have thick skin pigment that acts as insulation to keep them warm. Their houses are also round and thatched with kunai grass, hut on the ground.

The **Sepik River people** on the other hand build their houses on high stilt posts to avoid the rising water level during heavy floods.



Sepik River



Houses built on high stilt posts

Fiji is frequently hit by cyclones. Therefore, they build their houses with stronger brick to withstand the effects of cyclones and hurricanes.

Nunavut became Canada's third official territory on 1 April 1999. It covers an area of about 200 000 square kilometres of tundra, fjords and ice. Nunavut is one of the world's largest native title claims, where control of the land has been returned to the Inuit (once known as Eskimos). Nunavut (meaning 'our land' in their own language)

has a population of only 26 000 people, 85 per cent of whom are Inuit. Traditionally, the Inuit lived in harmony with their harsh Arctic environment, by hunting, fishing and trapping.

In the 1950s and 1960s the Canadian government built villages and schools causing a change in the nomadic lifestyle of the Inuit. Today the Inuit face many problems such as unemployment, poverty and poor formal education. However, the future is now in their own hands, as the Inuit come to terms with an ancient culture in a modern world.

In parts of **South East Asia**, the terrain (piece of land and its natural features) is rugged and mountainous. People have cut terraces on hill and mountain slopes to plant rice. Irrigation is done in dry tropical crops.

The **Uygur people of the Western Deserts of China** live in a very dry place. Their culture demands respect for water as very important. Respect for water helps them to conserve it. Traditionally, when guests enter a home or dwelling, the host (owner of the house) pours a little water on their hands. This lets them wash their hands and is a sign of respect by giving some very valuable water to the guest.



Uygur people live in deserts



a hut where people live in



Underground irrigation system



water is very scarce

The Australian Aborigines

When Captain Cook landed in Australia in 1770 there were about 300 000 Aborigines living on the island. There is evidence that they have lived there for over 50 000 years. Their rock paintings are older than those at Lascaux in France and pre-date the Egyptian Pyramids by 10 000 years. The majority lived close to the northern coast or inland near to rivers or Ayers Rock. They had very strong family ties, strong religious beliefs, which were sacred.

The Aborigines' diet, which some suggest contained over 350 different items of food, included emus and their eggs; kangaroos and wallabies; grubs and ants; acacia seeds, roots and grasses. Those living near rivers caught fish and crocodiles, while others on the coast ate turtles, crabs and mussels. Their main hunting weapons were boomerangs, long spears, shields, stone axes, fishing nets and fish hooks. As the food supply was limited, the population remained stable in size.

By 1930, only 70 000 Aborigines remained and their lifestyle was severely threatened. Recently, they have been given land rights to one-third of the Northern Territory (including Ayers Rock) and one-fifth of South Australia.

Today, relatively few Aborigines survive in their natural environment as economic and population pressures (numbers have now increased to 160 000) have forced many to leave the reserves and migrate to urban centres.

There, Aborigines tend to experience discrimination and poverty, an infant mortality rate twice the national average and a life expectancy 20 years less than the national average. They have poor housing and education, with few rights, many fall victims to social problems. Indeed, Aborigines face all the problems of an immigrant ethnic minority when in fact they were the indigenous inhabitants.

The physical environment and the settlement patterns

The physical environment has had great effect on the settlement patterns. Where the environment is suitable more people decide to settle in there. Few people live in environments that are harsh. For instance, more people would prefer to live in plains where the land is fertile, have easy access to transport, clean water or rivers for irrigation and farming activities.

The population in a desert area would be dispersed due to the environment there. People cannot be able to grow food or look after animals in a desert area. That is why; it will have a dispersed type of settlement pattern.

However, people have adapted to these difficult environments. They have no choice but to make use of any little resources they have and have well adapted to these harsh conditions. After a while, they become used to these environments and live for the rest of their lives.



Summary

You have come to the end of lesson 15. In this lesson you have learnt that:

- people have adapted to live in their natural environment over the past 50 000 years.
- people have adapted to live in the very cold polar regions, very dry hot and cold deserts, very wet and hot tropical regions and also in high altitude areas (mountains).
- people modify clothes/dress, architecture, (houses), transport and resource use to live in their natural environments.
- people structures have also been modified over live to live in this harsh climatic and topographical setting.
- examples of body structures that have been modified includes: thick skin pigments and larger lungs.

NOW DO PRACTICE EXERCISE 15 ON THE NEXT PAGE



Practice Exercise 15

1. Explain how culture can influence conservation of scarce resources in dry environments?

2. What kind of clothing and shelters are needed to live in the arctic regions?

3. List one very important resource that is plentiful in humid environments.

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 2
--

Lesson 16: Settling the World



Welcome to Lesson 16. In lesson 15, you learnt about how human beings have adapted to live in their natural environments. In this lesson, you will study how human beings have settled and lived in the different parts of the world.



Your Aims:

- describe the different periods of migration and colonisation of land around the world.
 - state reasons why the world was settled and the different trends over the years.
-

Settling the world

No historical records exist that tracks the migratory patterns of the earliest humans. Scientists put together the story of human migration by studying the tools, art and burial sites they left behind and by tracing genetic patterns.

Early Migration Routes

When humans first left Africa, they followed the coasts, where resources were abundant (plenty). The first wave moved across the Middle East, into Southern Asia, and all the way down to Australia. This occurred roughly between 90,000 and 30,000 years ago.

Additional waves of migration followed. Between 40,000 and 12,000 years ago, humans moved north into Europe. However, their range was limited by an ice sheet that extended into the northern part of continental Europe.

The icy conditions at the time also helped expand early humanity's territory. A large sheet of ice, combined with lower sea levels, formed a bridge between Siberia and Alaska. The first humans crossed over 30,000 years ago, moving down the west coast of North America.

Other sources suggest a more recent North American migration, starting about 15,000 years ago. Humans moved into South America and pushed east into what is now the eastern United States and Canada.

There have long been competing theories that early humans crossed the Atlantic Ocean, either from Africa to South America or the Caribbean or from Europe to Greenland to North America. While it may have been possible to make such a trip using available seafaring technology, it is unlikely that a large-scale migration occurred in such a way.

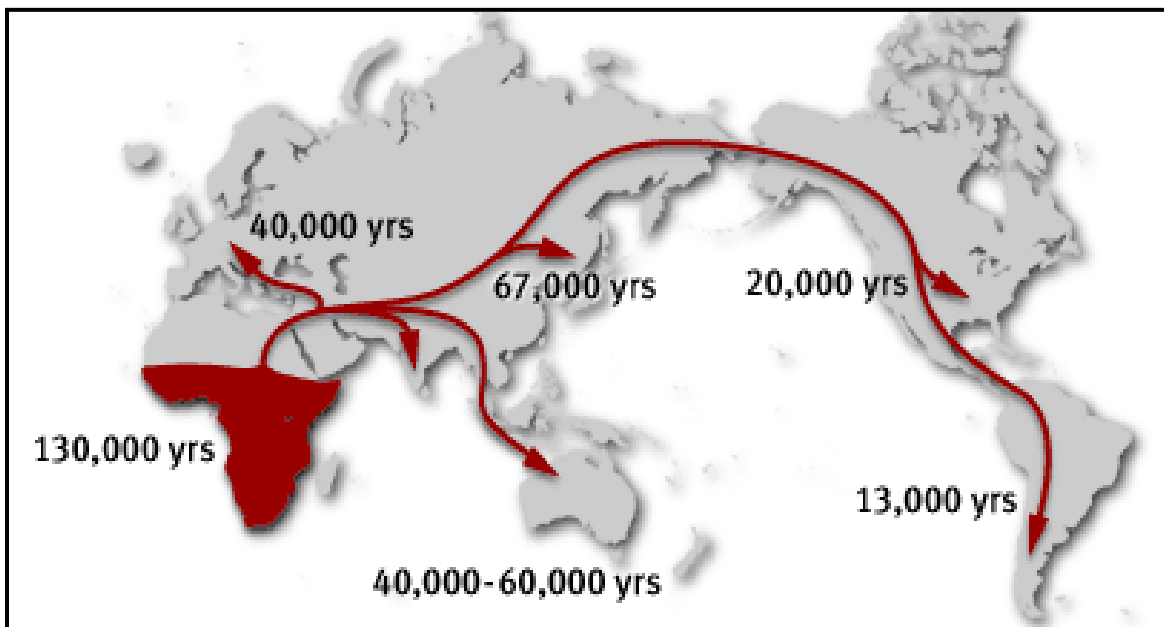
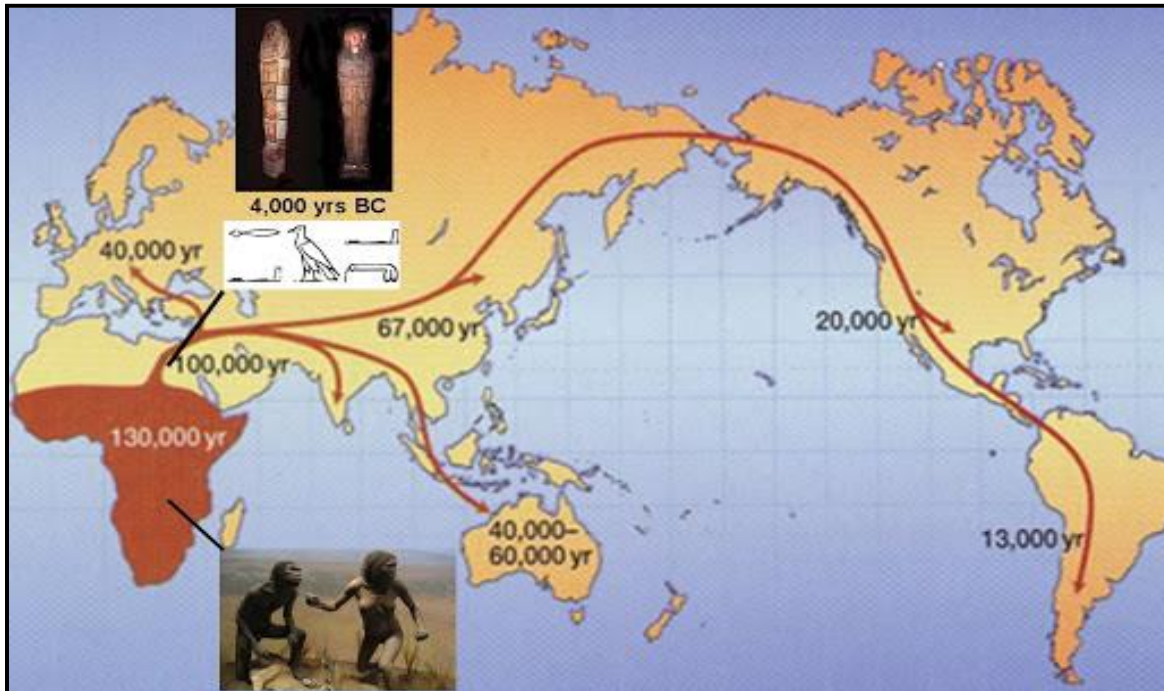
The main reason why people have spread and settled in all parts of the world was for food and by the climate. Nomadic tribes of up to a few dozen people likely followed the migration patterns of the herd animals they hunted.

Climate change opened new areas for hunting, even as technology such as mastery of fire and meat preserving allowed humans to live in less-than-ideal conditions.

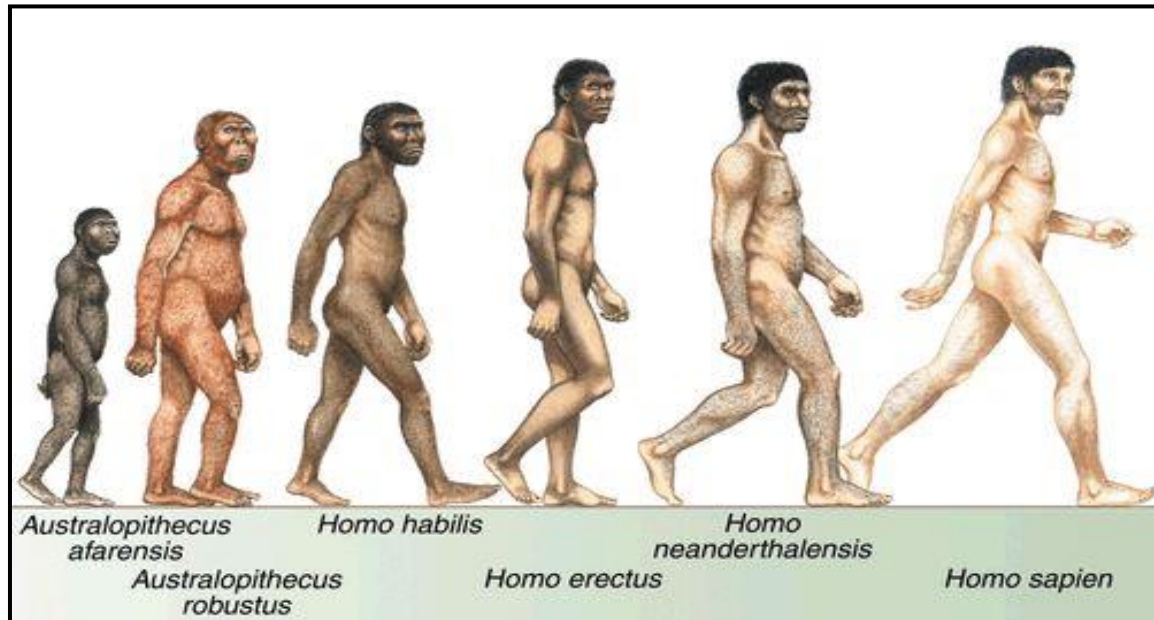
Some scientists think that it was accidental. They think that the early migrants got caught accidentally by a flood or tsunami and floated across on debris like uprooted trees.

Other scientists think that the first migrants had simple rafts. These scientists may be biased in thinking early humans could not make more difficult boats.

Early Human Migration Routes



History and Existence of Homo Sapiens (Modern Man)



Australopithecines, (very early human ancestors), spent some of their time in trees. Australopithecines had long, curved fingers that helped them grasp branches for climbing. In the treetops they were safe from enemies such as lions, but they could also walk upright and spent a lot of time on the ground.

Another type of early human, **Homo erectus**, lived on Java one and a half million years ago. Perhaps it was some type of Homo erectus that travelled to Flores Island. Perhaps they became smaller people over time. The little people of Flores made stone points, probably for spears that have been found with their remains at a cave in Flores. They hunted a type of small elephant that lived on the island. The elephant weighted about 350 kilograms. They would have needed special skills to hunt such a big animal.

Neanderthals were strongly built people who lived in Europe for about 200 000 years. Then they disappeared completely about 30 000 years ago. That means they were in Europe with modern humans for at least 10 000 years. Presently, scientists think that Neanderthals kept in small groups. Modern humans might have had links to larger groups to help in times of trouble. No one is sure what happened to the Neanderthals, but after 10 000 years of co-existing with modern humans, they had all disappeared.

Scientists have found the remains of a type of very small people on Flores Island in Indonesia. The adults only stood one metre tall. They lived on Flores from about 95 000 to 13 000 years ago. Modern human beings only arrived in Flores perhaps 50 000 years ago. The little people were there for about 45 000 years before modern human beings. It seems they lived together for over 30 000 years. Eventually, the little people vanished (disappeared). Even today, people on Flores Island have stories about small hairy people who lived deep in the mountains on the island.

Homo sapiens, is the name given to modern humans by scientists, which includes us. These humans have only been on earth for about 200 000 years. Early remains of first modern human, which date back to about 120 000 years ago have been found in *Omo Kibish* in Ethiopia (South Africa). These people spread west, south and to the northeast.

Modern human remains that date back over 90 000 years ago have been found in Israel, but this group seems to have died out. They seem to represent an unsuccessful migration from Africa.

Even early types of people can be traced back to find human ancestors that date back to about 7 million years ago.

Groups of modern humans began to leave Africa around 70 000 years ago. World climates were colder. It was not until the last ice age. Sea levels were lower than they are today. This might have made it easier to travel. Or people may have been making better canoes and boats to travel along the coasts.

No one is sure how long it took to populate the world with modern humans. We do know that, all of us are related to the people who left Africa 70 000 to 50 000 years ago. We do not know how many different groups left, why they travelled or how they travelled. All we have today is the evidence of arrivals from a few places around the world.

In 2007, genetic evidence published in the Proceedings of the Natural Academy of Sciences suggests that Asians played a larger role in colonising Europe than Africans. This is just one example of how science adds new information to our understanding of early human settlement. All we can be sure of is that, more discoveries will continue in science for us to better understand our past.

There were other groups in Asia, Europe and Africa. For nearly two million years, tool-making types of humans have left Africa. Stone tools and remains have been found in Europe and Asia which date from 1.5 to 1.8 million years old. All these types of humans have disappeared. All that is left are fossils, and some stone artefacts.



Summary

You have come to the end of lesson 16. In this lesson you have learnt that;

- scientists put together the story of human migration by studying the tools, art and burial sites early people left behind and by tracing genetic patterns.
- early humans have migrated from Africa to all parts of the world.
- it is believed that a global migration from Africa took place in the last ice age, when sea level was lower.
- the first wave of migration was across to the middle east into southern Asia and all the way down to Australia in between 90 000 to 30 000 years ago.
- additional waves of migration were to; Europe between 40 000 and 12 000 years ago crossed over to west coast of North America, 30 000 years ago and finally moved south wards and settled in South America.
- humans have spread and settled in all parts of the world because of the climate, in search of resources (food) and some accidentally drifted away on rafts by the sea, by flood or tsunami.
- australopithecines, (very early human ancestors), spent some of their time in trees.
- homo erectus, another type of early human lived on Java one and half million years ago.
- neanderthals were strongly build people who lived in Europe for about 200 000 years.
- homo sapiens is the scientific name for modern humans.
- modern humans appeared on earth about 200 000 years ago.
- the earliest remains of humans were found in Ethiopia.
- all these types of humans have disappeared. All that is left are fossils, and some stone artefacts.

NOW DO PRACTICE EXERCISE 16 ON THE NEXT PAGE



Practice Exercise 16

1. What is the scientific name for modern humans?

2. In which country, was the remains of earliest human beings found?

3. What climatic condition may have made it possible for the first wave of human migration out of Africa?

4. Why did early humans spread and settle in all parts of the world?

5. How many years ago did early humans occupy the European continent?

CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 2
--

Lesson 17: World Population



Welcome to lesson 17. In the previous lesson, you have learnt about how people settled in the world. In this lesson, we will study World Population. We shall look at the population by reading graphs and pyramids.



Your Aims:

- define population
- explain population density
- explain why population increase
- explain why population decrease

Population and Population Density

Population refers to the total number of people living in a particular place at a given period of time.

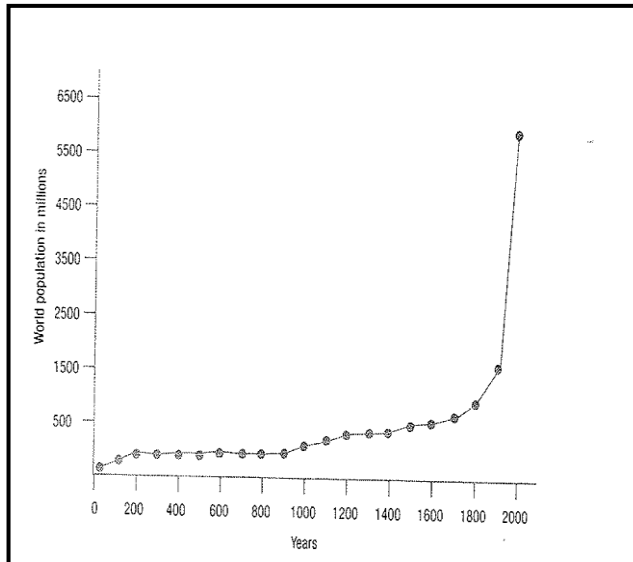
World Population

The world population is not spread evenly around the earth. It is hard to live in many parts of the biosphere. For example, Antarctica has no permanent settlements and very few people live in the Sahara Desert. Human beings have changed the face of the earth. Human settlement and use of resources now has a growing impact on the land, the oceans and the atmosphere.

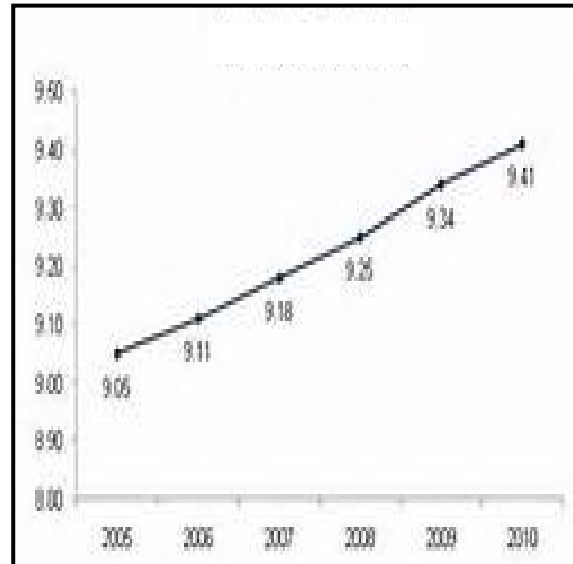
No one knows how many people had settled around the world thousands of years ago. Maybe it was one million or as high as ten million. All we know is that population growth was slow for a long time.

In the last century, this growth has increased rapidly. In 1900 (twentieth century), the world's population was less than two billion people. In 1959 it reached three billion and in 1999 it doubled to six billion. By June 2007, there were almost seven billion people on earth. Scientists estimated that there will be nine billion people by the year 2050.

World's Population Growth



Population Growth - PNG



Two things are now happening as populations grow.

First, while the rate of population growth today is very rapid, it will be much slower in fifty years' time.

Second, city populations are growing faster than rural populations as more people are moving to cities.

This can make **population density** very high in some places. The largest cities of the world have very dense populations.

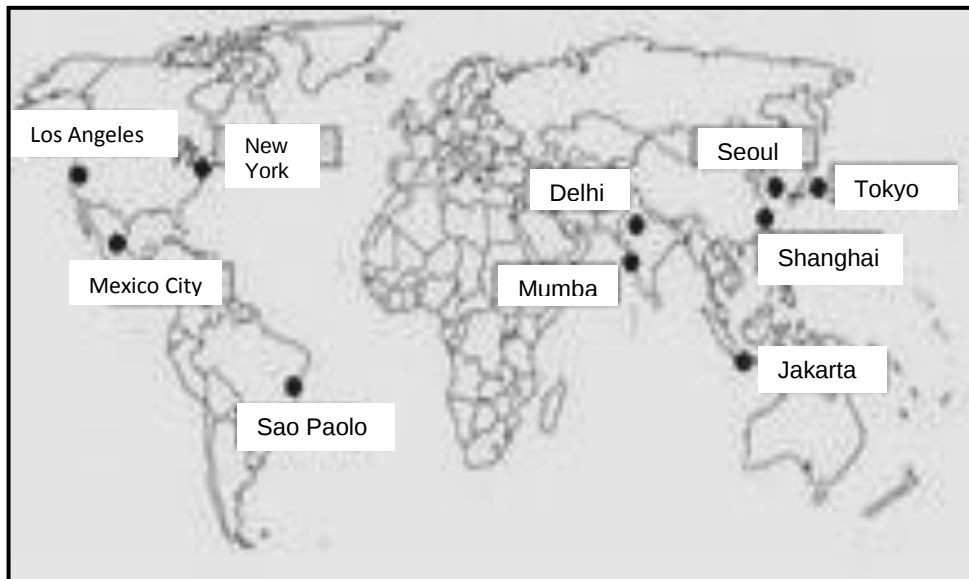


Busy road in Lagos

New cities are being made all over the world. Old cities are getting bigger, as rural people are migrating to cities. An example of a large urban settlement is the area from Boston to Washington D. C., in the United States of America. New York and Baltimore are all part of this giant urban area.

Likewise, in Papua New Guinea we have Port Moresby and Lae which are two growing cities. As cities expand human settlements will also increase like what is experienced in Port Moresby today.

Top Ten Largest Cities of the World



Over 25 million people	17 – 18 million people	12 – 14 million people
Tokyo (Japan)	Mexico City, (Mexico), Mumbai (India) Sao Paulo, (Brazil) New York, (USA)	Shanghai, (China) Los Angeles (USA) Seoul, (South Korea) Delhi (India)

Growing populations

Most population growth is taking place in the developing world. Papua New Guinea has about six million people.



The growing city of Port Moresby

Countries by population in the year 2000		Countries by population in the year 2050 (estimated)	
Country	Population	Country	Population
China	1 268 853 362	India	1 807 878 574
India	1 004 124 224	China	1424 161 948
United States	282 338 631	United States	420 080 587
Indonesia	213 829 469	Nigeria	356 523 597
Brazil	175 552 771	Indonesia	313 020 847
Russia	146 709 971	Pakistan	294 995 104
Pakistan	146 342 958	Bangladesh	279 955 405
Bangladesh	130 406 594	Brazil	228 426 737
Japan	126 699 784	Congo (Kinshasa)	183 177 415
Nigeria	114 306 700	Mexico	147 907 650

Population density is the number of people living in a square kilometer of land at a particular time. Population density of a country or place is a way of showing how crowded that place is. It is calculated by dividing the **population** by the **area**.

$\text{Population Density} = \frac{\text{Total Population}}{\text{Area (square km)}}$

For example; the population of a country is 60 561 200 and the area is 55 1695 square kilometer. Therefore,

$60\,561\,200 / 551695 = 109.8 \text{ persons per square kilometer (Km}^2\text{)}$
--

Areas with High Population Density

Country/Territory	Population	Area (square km)	Density
Macau	541 200	29.2	18,534
Monaco	33 000	1.95	16,923
Singapore	5 076 700	710.2	7,148
Hong Kong	7 003 700	1104	6,349
Gibraltar (UK)	31 000	6.8	4,559

Population Increase

Population has increased over the years. Below are reasons of factors which cause an increase in population.

1. Increase in birth rates

More children are born because of early marriages, lack of awareness on family planning, lack of education and beliefs and customs.

2. Better Health Care

Better and improved sanitation has led to fewer diseases. This has improved the standard of living. People have money to improve their health.

3. Better transportation and distribution system for food.

Better transportation systems have helped to distribute food so that everyone has access to obtaining food.

Population Decrease

Sometimes population decrease as a result of;

1. War

Hundreds and thousands of people are killed in wars.

2. Out - Break of diseases

Unexpected break-out of diseases that kill thousands of people. People are not prepared for it, therefore lives are lost.

3. Severe natural disasters like earthquakes, tsunami, cyclone and fire.

Natural disasters may occur when least expected which kills many people.

4. High death rates

Lack of proper medical facilities result in high death rates

**Summary**

You have come to the end of lesson 17. In this lesson you have learnt that:

- population refers to people who live in a particular place at a given time.
 - scientists estimate that there will be nine billion people by the year 2050.
 - population density is the number of people living in a square kilometer of land.
 - population density is calculated by dividing the population by the area of land.
 - the world population is not spread evenly around the earth.
 - populations decrease because of war, natural disasters, high death rates and break – out of certain diseases.
 - populations increase due to improved health services, better transportation systems for the distribution of food and high birth rates.
-

NOW DO PRACTICE EXERCISE 17 ON THE NEXT PAGE



Practice Exercise 17

1. What is population?

2. Explain Population Density

3. Calculate the population density of Papua New Guinea. (*Land area – 786 000 square kilometer and total population in 2011 census is 7 059 653*);

4. List two reasons each for population;

(i) increase

(ii) decrease

CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 2
--

Lesson 18: Population Maps and Graphs



Welcome to lesson 18. In the last lesson, we looked at population, its effects and why it increases and decreases. In this lesson, we will learn about population maps and graphs.



Your Aims:

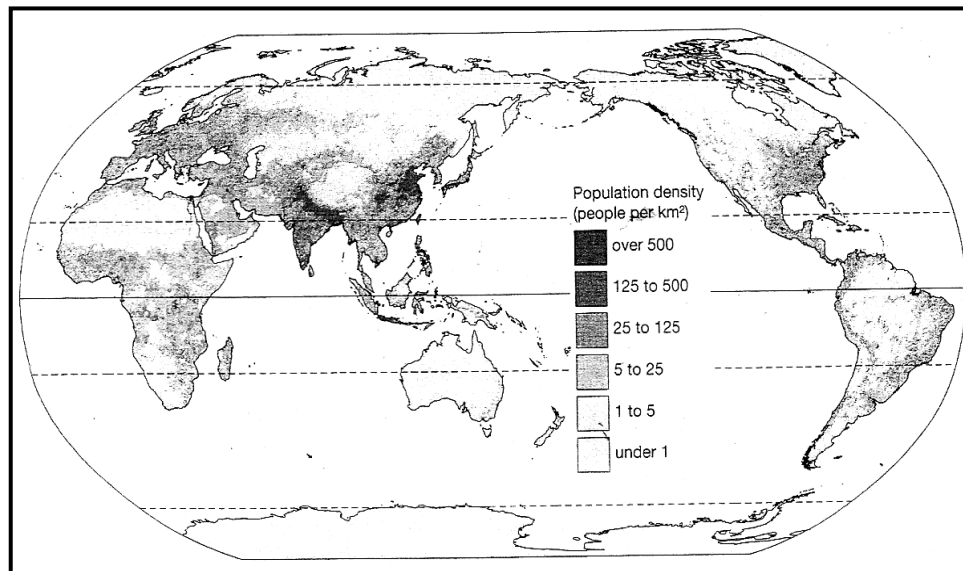
- define population maps and graphs
 - study population maps and graphs
-

Population Maps

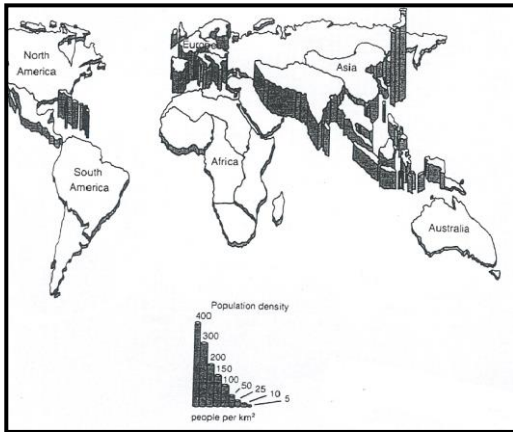
A population map is an accurate drawing of the earth showing the location and distribution of population figures in each province or country. To understand a population map, we must have a number of **map reading skills**. That is, we must understand the keys and scales.

Population maps are shaded with different colours or dots to show the distribution of population. Below are examples of population maps.

A World Population Map



A Stylized Map



A Dot Map



Population Graphs

In order for a population graph to be drawn, we have to have statistics (numbers). This can give us a lot of information about the population of people on the earth.

Showing information on population graphs is known to be one of the best ways of getting across the message. Population graphs can show us the important facts at a glance.

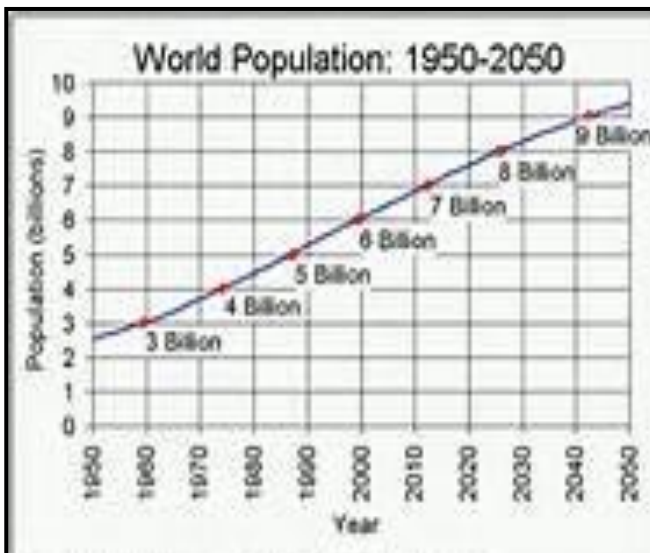
They can be drawn using:

- i) line graphs
- ii) column/ bar graphs
- iii) pyramids
- iv) pie graphs

Now, let us look at examples of various population graphs below.

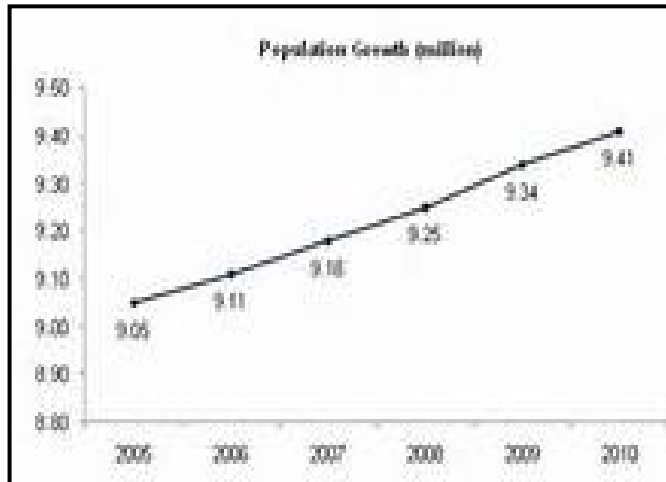
• Line Graph

World Population Growth



This line graph shows the increase in the world's population from 1950 to 2050. You can see that in between 2010 and 2020, the world population is about 7 billion. The line is increasing from the left to the right.

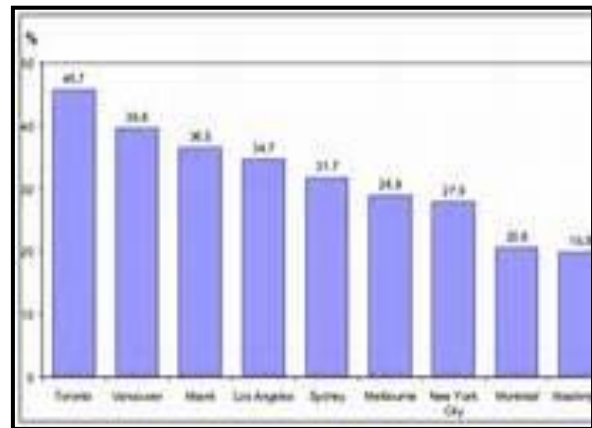
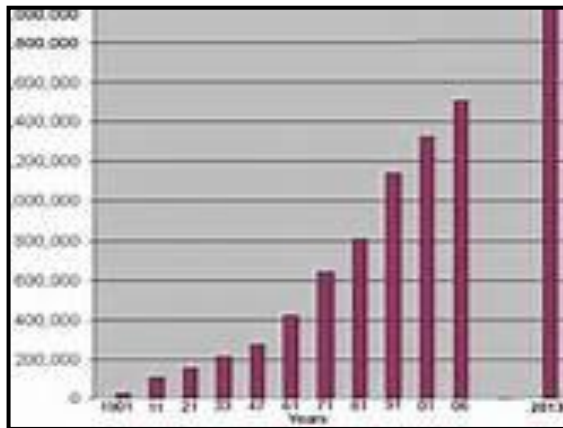
Population Growth - PNG



Papua New Guinea's population growth from 2005 to 2010. It is shown in percentages.

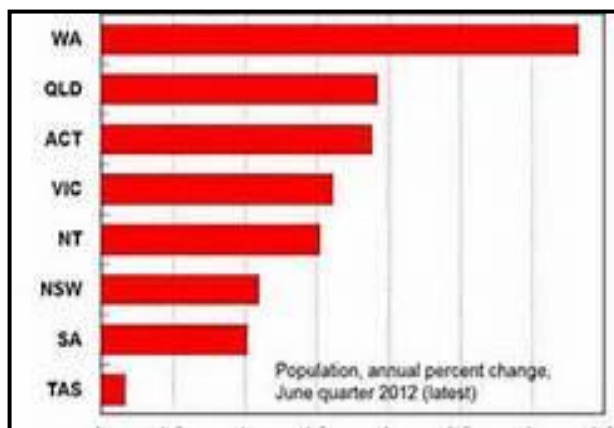
- Column Graph**

Below are examples of column graphs showing population growth.

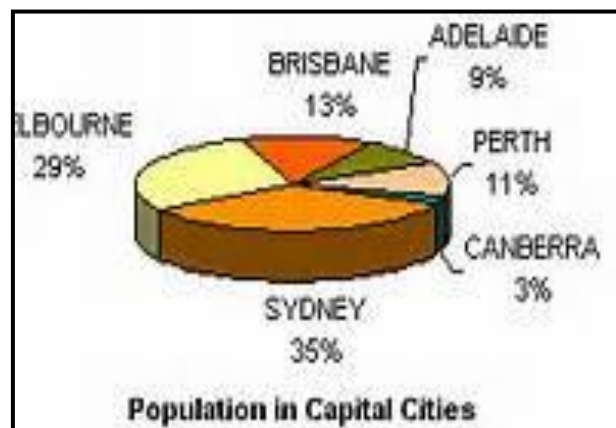


On a column graph, the numbers of people are shown on the left-hand corner along the vertical axis while the years are shown on the horizontal axis. Even though, the graphs are not clear, it is important to see what a column graph looks like.

- Bar Graph**



- Pie Graph**



- **Population pyramids (age – sex graphs)**

A population pyramid is a special graph that shows the number or percentage of people in particular age groups living in a country, state or city.

The things people need, buy, do and think is determined to a certain extent by their age and sex. This means that information about the age and sex structure of a population is very important for social and economic planning. Such information is needed as a basis for decision-making on matters such as the provision of educational facilities, welfare for the aged, housing, and health services.

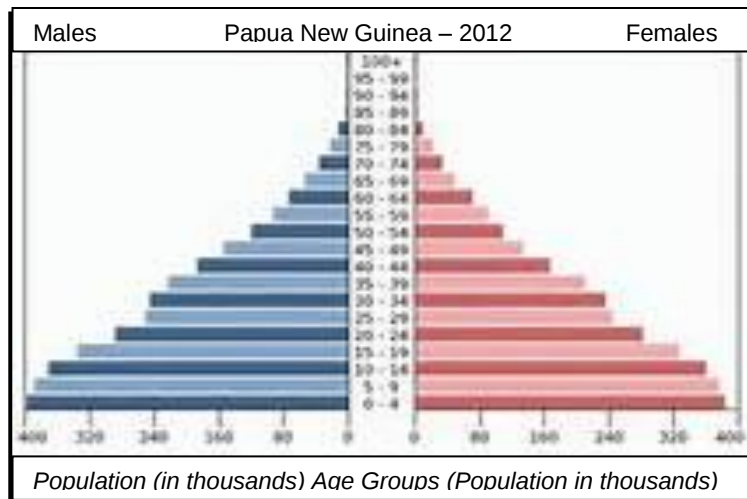
Interpreting population pyramids

- The vertical axis (up along the centre) represents the various age groups.
- The horizontal axis usually divides the population into males and females. Males are usually shown on the left and females on the right.
- The scale on the X-axis can be shown either as a number or as a percentage.
- Two basic population pyramid shapes can be found:

(A)

The shape of the pyramid is like a triangle, similar to the one below. The base is large because there are male babies being born. However, the death rates or mortality rates, although falling, are still high. This means only a small number of people live to old age.

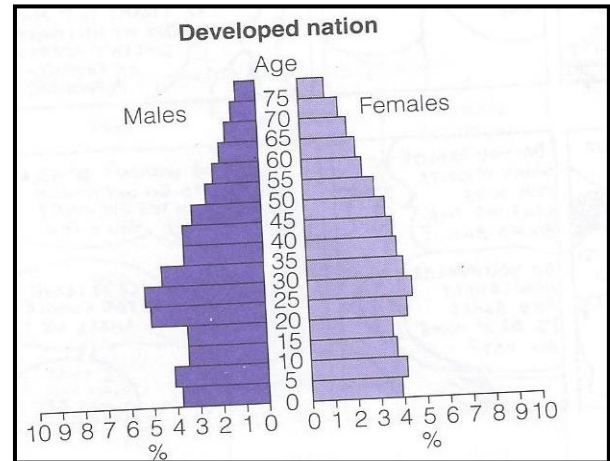
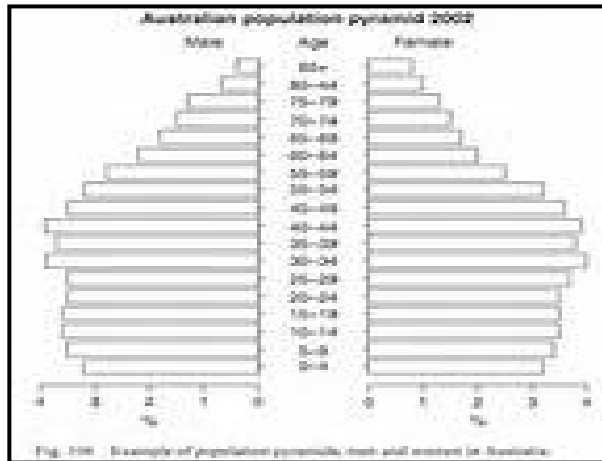
For example, Papua New Guinea and its population pyramid shown on your right.



Third World (developing) Countries have population pyramids which look like this.

(B)

The shape of the pyramid is roughly like a beehive. The base and the top are similar shapes, although in some cases the base is becoming smaller. This is due to a decline in the number of births, and to low mortality rates (a large number of people have to old age).



Population pyramids for developed countries



Summary

You have come to the end of lesson 18. In this lesson you learnt that:

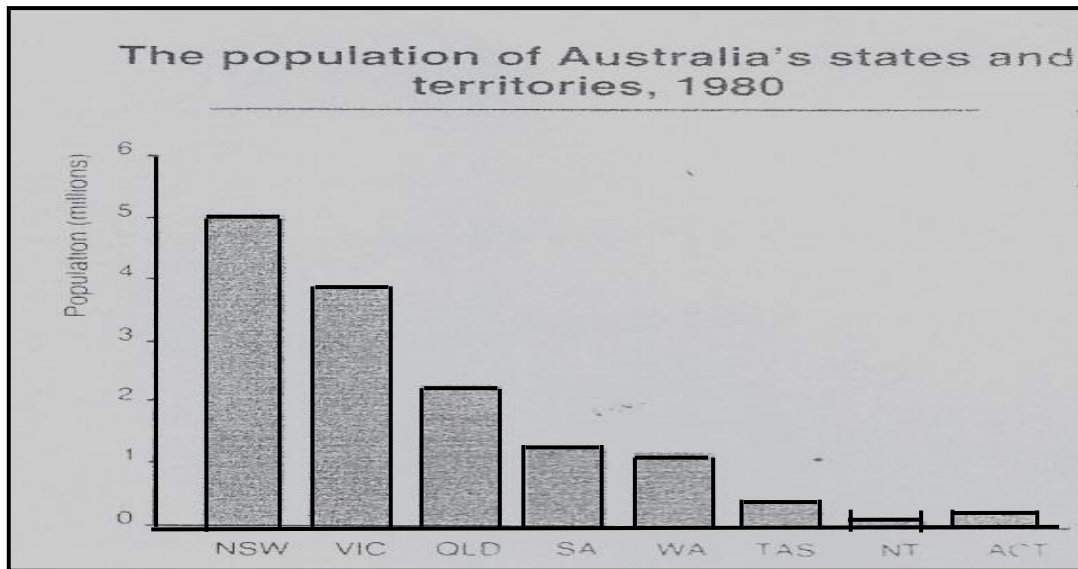
- population maps show actual locations and distributions of population in a province or nation.
- to understand population maps, we must have map reading skills.
- population maps can be dotted, coloured or styled
- information on population graphs are drawn using statistics (numbers).
- population graphs can be drawn using line graphs, pyramids or in column or bar graph.

NOW DO PRACTICE EXERCISE 18 ON THE NEXT PAGE



Practice Exercise 18

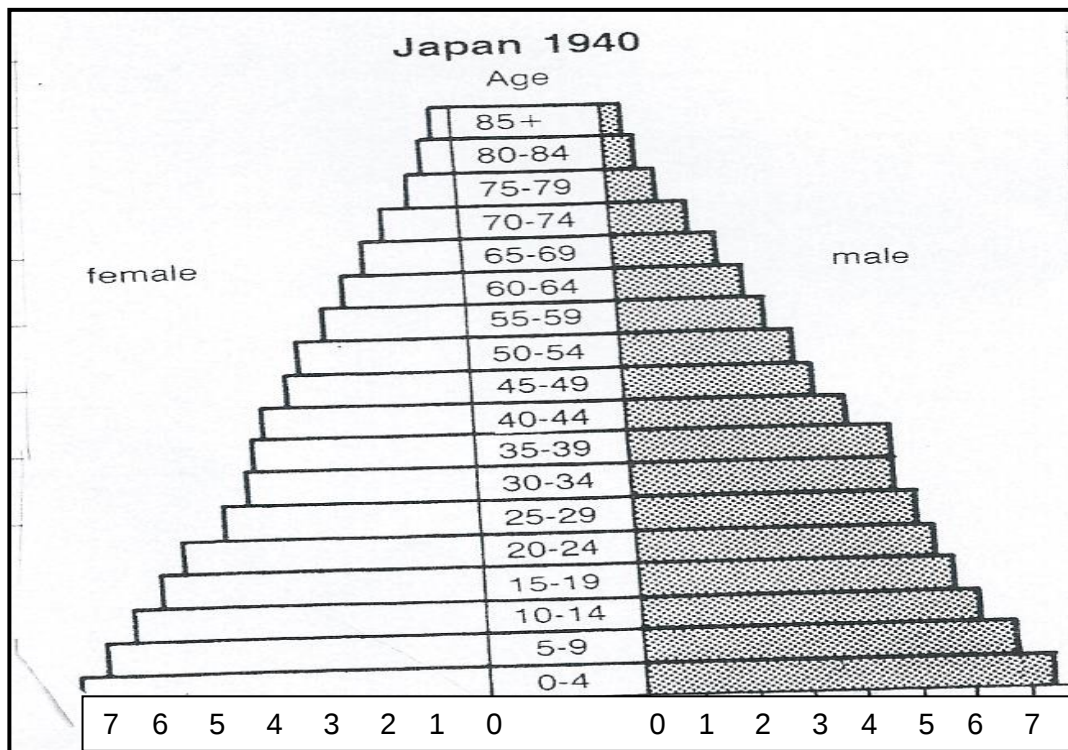
For questions 1-2, refer to the graph below.



1. Which state or territory has the smallest population? _____
2. How many states have a population over 1million? _____
3. Study the pie graph showing Australia's population to answer this question.
Which state has the highest population in percentage?

4. Study the population pyramid of Japan on the next page to answer these questions.
 - i) What percentage of Japan's population in 1940 was aged 0 - 4 years old?

 - ii) Which age groups had the highest percentages in 1940?



CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 2

Lesson 19: Urbanisation



Welcome to lesson 19. The last lesson was on showing population on different types of graphs and maps. We will now learn about urbanisation.



Your Aims:

- define urban and urbanisation
 - state the advantages and disadvantages of urbanisation
 - explain why urbanisation takes place
 - identify the capital and largest cities in the world
-

Urban refers to cities. More than half of the world's populations now live in cities.

Urbanisation is the expanding (become bigger) or growing of a settlement to a city. Many cities in the world are growing very quickly, as fewer people choose to live in rural areas. Growth of cities also means a greater demand for services such as schools, gas or electricity and a greater demand on resources such as water.

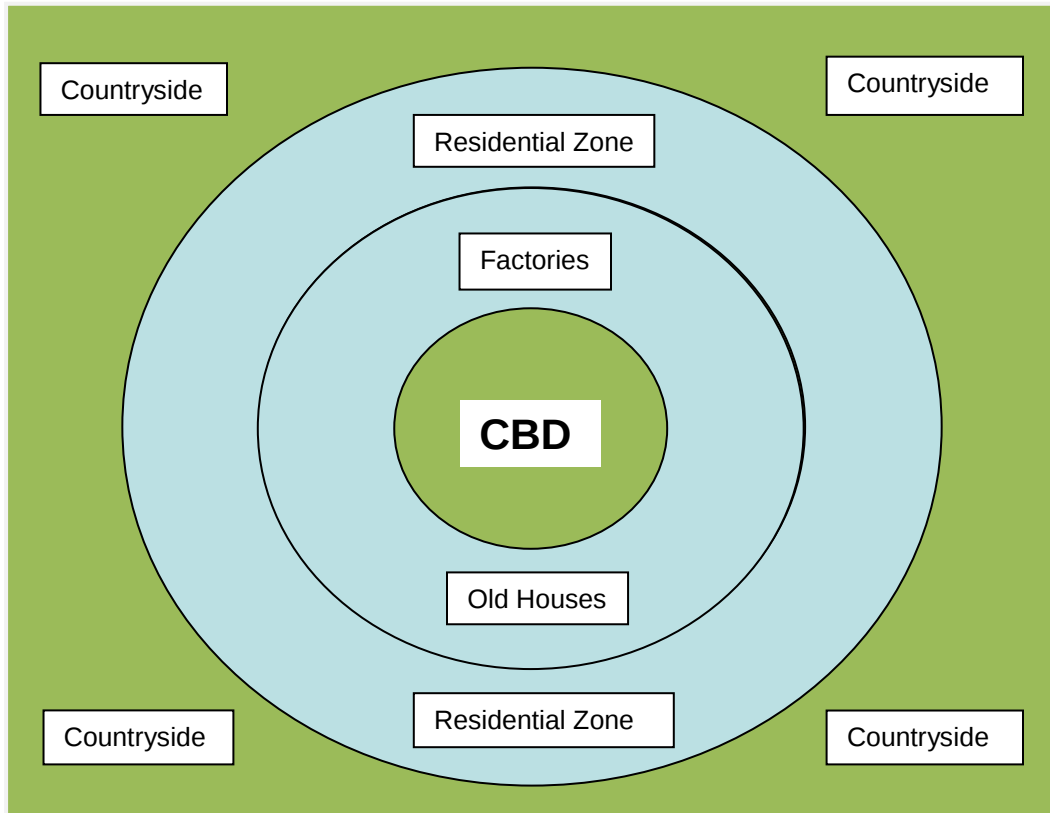
The populations in cities and towns are growing big. Cities are becoming over-crowded. What can you find in a city? There are many people, houses, factories, government offices, schools, shopping centres, hospitals, sports grounds, cinemas and parks.

A city is a very large urban settlement. A city has many people living in it and has buildings of many different purposes. As cities grow, so do their functions due to its growing population. As a result, more land will be needed to expand their activities.

Cities can be divided into areas or zones according to the purposes of the buildings in those areas.

- The **Central Business District** (CBD) is the centre of the city, where most of the commercial and business activities take place. They have shops, offices, banks as well as the administrative centre.
- The **light industrial zone** is where factories are found. You may also find very old residential houses in that area. These are small manufacturing places, e.g. furniture shops.
- Further out towards the edges of the city, we have the **residential zones**. These are areas of the city where people have their houses to live in. Most people live in those areas. Mixed up among these zones are open spaces, parks and playing fields, for people's **recreation**.

The diagram shows the expansion of a city and how the land is used;



Why do you think the urban population is growing very fast? There are many attractions in the city that pull people to cities and towns. While at the same time, the rural places become unattractive due to lack of services and opportunities.

Pull Factors are desirable things found in the city which are not available in the rural areas.

Push Factors are undesirable events or conditions that make or cause people to leave rural areas and go to live in cities.

Push Factors	Pull Factors
- tribal fights (conflicts) in rural areas - over population and shortage of land - natural disaster like floods, drought and many others	- in search of basic services such as ; education, health, good transport system, etc - in search of employment (better jobs) - bright lights, the bars, discos, cinemas and clubs attract people

The biggest increases in urban growth come from the cities in the developing countries. The greater the number of people in the city, the greater the needs to consume available resources. As urbanisation rates increase, the growth of very large cities increases.

The largest cities in the world, with more than 10 million people are called mega cities. There are about 20 mega cities in the world today.

According to United Nations Population in 2003, there are 10 world's largest cities.

Largest Cities in the World

Over 25 Million People	17- 18million People	12-14 Million People	10-11 Million People
Tokyo, Japan	Mexico city, Mexico Mumbai, India Sao Paulo, Brazil New York, USA	Shanghai, China Lagos, Nigeria Los Angeles, USA Calcutta, India Buenos Aires, Argentina Seoul, South Korea Beijing, China Karachi, Pakistan Delhi, India	Dhaka, Bangladesh Manila, Philippines Cairo, Egypt Osaka, Japan Rio de Janeiro , Brazil Tianjin, China

It is often hard to get correct count of population figures as some cities count only people within their official boundaries, while others include areas which are becoming part of the city. Try to hear from news or read newspapers to find out the current (2014) mega city that is leading with the highest urban population in the world.

Some sources give Mexico City as the world's largest city. It has the highest level of migration of unemployed farm workers to the city seeking a better life. Many people within the city live in poverty.

Why do you think people are interested in knowing the numbers of urban population?

- One important reason to know about urban human numbers is to help plan the city well for meeting all the needs and wants.

Many large cities developed because of modern technology. Today streams of people continue to migrate around the world searching for better economic opportunities. Others are fleeing conflict and repression. They are refugees. Some are forced to flee their land for their lives. This reflects a growing world population with conflicts over resources.

Advantages and Disadvantages of Urbanisation

Advantages	Disadvantages
○ protected from disaster ○ chances to earn money ○ a lot of entertainment ○ education opportunities ○ better services like health, schools and roads	○ unemployment ○ poverty ○ over crowding ○ bad influences like; - drinking - rascalism - prostitution

Have a look at some of the cities mentioned above



Mexico City, Mexico

Mexico City is the capital of Mexico. It is one of the world's largest cities.



New York City

New York is the biggest city in United States. This photograph shows some of the city's many skyscrapers (tall buildings).



Tokyo, Japan

Tokyo is the capital and largest city in Japan. It serves as Japan's economic and cultural center.



Los Angeles, California

Los Angeles, California, is the second largest city in United States.



Summary

You have come to the end of lesson 19. In this lesson you have learnt that:

- urban refers to cities.
- urbanisation is the expanding (become bigger) or growing of a settlement to a city.
- people either choose to move to cities or are pushed out of rural areas.
- the Central Business District (CBD) is the centre of the city, where most of the commercial and business activities take place.
- the light industrial zone is where factories are found.
- residential zones are areas of the city where people have their houses to live in.
- push factors are desirable things found in the city which are not available in the rural areas such as; tribal fights, over population and land shortage, natural disasters and unemployment.
- pull factors are desirable things found in the city which are not available in the rural areas such as; basic services like education, health and entertainments.
- large cities developed because of modern technology.
- urban human numbers are important to help plan the city well for meeting all the needs and wants.

NOW DO PRACTICE EXERCISE 19 ON THE NEXT PAGE



Practice Exercise 19

1. What is urbanisation?

2. Write three reasons why people move to cities (pull or push factors)?

i) _____

iii) _____

iv) _____

3. Use the *Papua New Guinea secondary School Atlas* to locate the continents that these cities are on.

Tokyo _____

Los Angeles _____

Cairo _____

Calcutta _____

4. Write the country for these cities.

Delhi _____

Seoul _____

Sao Paulo _____

New York _____

Beijing _____

5. Why is it important to know the number of people living in a city?

CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 2
--

Lesson 20: Urbanisation: A comparative study



Welcome to lesson 20. In lesson 19, we looked at urbanisation. In this lesson, we will learn about urbanisation in two different countries and do a comparative study.



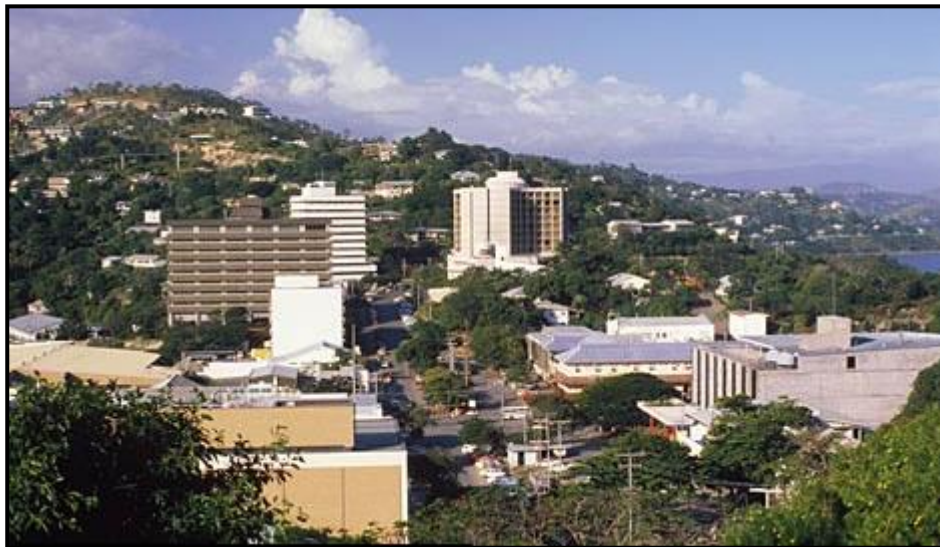
Your Aims:

- identify reasons for urbanisation in Port Moresby with another capital city in a developed nation
 - compare the similarities and differences of urbanisation issues
-

Where do migrants come from?

Most settlers in Port Moresby are **migrants** from different parts of the country. Unlike the Motu and Koita people of the traditional villages around Port Moresby, they generally have no traditional land rights in the area.

Most of the settlers come from other places in the Papuan region; particularly the Gulf and Goilala areas. Other are from Hula and Wanigela in Central Province, other recent migrants are from Chimbu, Eastern, Southern and Western Highlands. Very few have come from the New Guinea Islands and the Momase Region (Madang and Sepik Provinces).



Port Moresby

Papua New Guinea's capital, Port Moresby.

Why do people leave their villages?

There are many reasons why people move away from rural areas to urban centres.

Push factors

People often move away from their home area because conditions there become unsuitable. For example, some areas of Chimbu Province are overpopulated and the land cannot support all the people. In other areas, people have moved out because of natural disasters such as flooding, drought or some others which have destroyed their gardens and food crops. Some have even moved out because of tribal conflicts. These things **push** people away from their own villages. Most travel to urban centres, particularly Port Moresby and Lae, because they think they have a better chance of earning a living there.

Pull factors

Many people leave the rural areas because cities offer employment opportunities and the chance to earn more money. People who live in urban centres appear to enjoy better standard of living and have better services (health care and education) than people living in rural areas. Some are attracted by the 'bright lights' of the city, the bars, discos, cinemas and clubs. All of these attractions **pull** people from the villages to the big urban centers.

Urbanisation in Mexico

The world's population is growing rapidly but people are moving from rural to urban areas at an even faster rate. Soon half of the people of the world will be living in cities. Mexico is known to be one of the most populated nations in the world, and it is still developing despite the many technologies found in the nation.

Many people in Mexico migrate to the city;

- to look for more cultural and social groups
- because of low death rates and high birth rates in rural areas
- in search of better basic services like education, health and transportation system
- because of natural disasters
- because they are displaced by war

When comparing the pull and push factors of the two cities, the reasons why people move are the same.

Here are some of the similarities and differences of urbanisation issues in the countries discussed in our lesson.

Similarities	Differences
Port Moresby and Mexico ○ pollution ○ crime ○ poverty ○ over population ○ unemployment ○ uneducated ○ diseases like HIV/AIDS	○ internal migration policies are different in these cities ○ population control policies may vary ○ introduced measures to achieve more sustainable urban environments ○ Mexico (wars) ○ Port Moresby (settlement)



Summary

You have come to the end of lesson 20. In this lesson you have learnt that:

- The Main reasons of urbanisation are:
 - looking for employment (job) opportunities
 - better services like: - health and education
 - attracted by city lights
 - moving away to avoid natural disasters
 - running away from tribal fights
 - displaced by wars
- there are urbanisation issues such as:
 - pollution
 - crime
 - poverty
 - over population
 - unemployment
 - uneducated
 - HIV/AIDS

NOW DO PRACTICE EXERCISE 20 ON THE NEXT PAGE



Practice Exercise 20

1. List 4 reasons why people migrate to cities.

- i) _____
- ii) _____
- iii) _____
- iv) _____

2. Where do most of Port Moresby's settlers come from? _____

3. Explain these two phrases

- i) Push factors: _____
- ii) Pull factors: _____

4. Why do you think crime rates are so high in towns and cities today?

CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 2
--

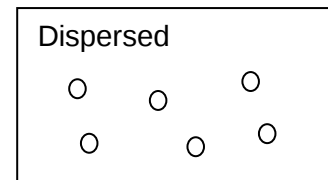
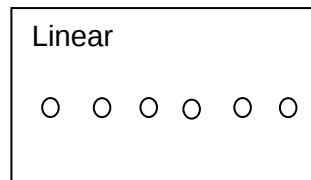
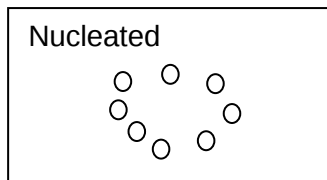
SUB-STRAND 2**ANSWERS TO PRACTICE EXERCISES 13 - 20**

Practice Exercise 13

1. Fiji was dismissed from the Commonwealth of Nations because of the coup it undertook in 1987.
 2. If ever PNG undertakes a coup, it will be dismissed from the Commonwealth of Nations.
 3. Five human features of Fiji are:
 - (i) people
 - (ii) economy
 - (iii) government
 - (iv) education
 - (v) urbanisation
 - (vi) cultural life
 4. The two racial groups that live in Fiji are;
 - (i) Indigenous/native Fijians
 - (ii) Indian Fijians
-

Practice Exercise 14

1. Economic (business opportunities, employment)
Physical (water, climate, fertile soil)
Technological (effective communication, road and banking systems)
Historical (same language and culture.)
2. The Southern New Guinea plains are only sparsely populated by relatively mobile sago gatherers. The Highlands valleys are densely (close together) settled, whether in villages or scattered hamlets. The north coast and the northern eastern are generally well-populated, despite the hazards of volcanic eruptions, regular earthquakes and rarely tsunamis. The island of Karkar and the Gazelle Peninsula are densely populated.
2.
 - i. Nucleated – cluster/together
 - ii. Linear – in a line
 - iii. Dispersed – spread out/scattered
3. Diagrams below



Practice Exercise 15

1. For example, the cultures of Uygur people of western China regard water as very important. Respecting water helps to conserve it.
 2. Warm clothing and shelters to keep them warm from the cold.
 3. Water
-

Practice Exercise 16

1. Homo Sapiens
 2. Ethiopia-Africa
 3. Sea-Level was lower making it easier for humans to cross continents.
 4. Climate and in search of resources especially food.
 5. 40 000 years ago.
-

Practice Exercise 17

1. Population is the total number of people who live in certain area or place.
 2. Population Density is the number of people living in a square kilometre of land
 3. $7\,059\,653 / 786\,000 = 8$ persons per square kilometer of land
 4.
 - i. high birth rates and improved health services
 - ii. war and natural disasters
-

Practice Exercise 18

1. Northern Territory
 2. 5 states have a population over 1 million
 3. Sydney
 4.
 - i. 7.5 %
 - ii. 0-4 and 5-9 year olds
-

Practice Exercise 19

1. The process of growth in a city.
 2. (i) For employment opportunities.
(ii) Better entertainment {other answers can be accepted}.
(iii) Over population
 3. (i) Asia (ii) North America
(iii) Africa (iv) Asia
 4. (i) India (ii) South Korea (iii) Brazil
(iv) USA (v) China
 5. To help plan the city well for meeting all the needs and wants
-

Practice Exercise 20

1. Reasons of migrating to cities;
 - i. education
 - ii. better health services
 - iii. natural disasters
 - iv. bright city lights**(NB: other reasons can be accepted)**
 2. From the Papuan region
 3. i) Things that push people away from their villages or from a rural area to a city.
iii) Things that attract people to leave their villages and migrate to cities.
 4. Because of unemployment
-

SUB-STRAND 3

CHANGING THE PHYSICAL ENVIRONMENT

In this sub-strand you will learn about:

- **Natural Resources**
- **Distribution of Natural Resources**
- **Addressing Environmental Issues**

SUB-STRAND 3

Changing the Physical Environment

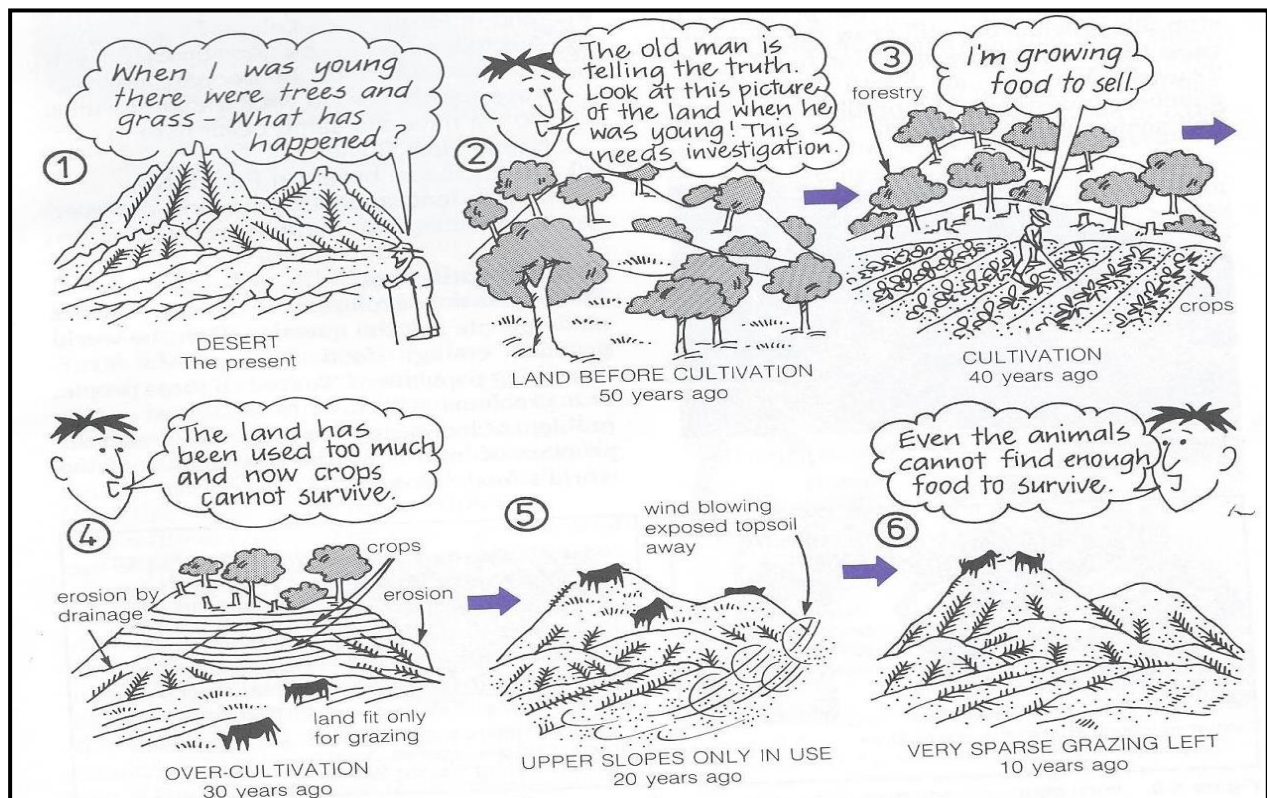
In this sub-strand, you will learn about how humans have influence on the natural environment. People have the power to change the physical environment into man-made environments.

You will identify the main natural resources which people have to satisfy their needs and wants. This sub-strand will tell you whether the resources are evenly distributed throughout the world or some parts of the world suffer because they do not have enough.

This will then, bring you to study how well these problems or issues are addressed. What and how can these environmental issues be addressed?

This is the Question, every individual should consider, when dealing with the usage of natural resources. **Think Of The Future Generation And Use Wisely.**

The Disappearing Forest and Soil



Lesson 21: Natural Resources



Welcome to sub-strand 3, lesson 21. In the previous sub-strand, you have studied how the physical environment affects human settlement patterns. Now, in this sub-strand we will learn about how people change the physical environment to satisfy their needs and wants.



Your Aims:

- define natural resources
 - list the main natural resources of the world
 - identify the impact of resource use on the world's physical or natural environments and human settlement patterns
-

What is a resource?

You studied natural resources in Grade 7. A resource is anything that is useful for people to use. For example, water, air, plants and animals, schools, hospitals and minerals. These resources are very useful for the survival of all mankind. For example, plants and animals depend on each other. Plants and animals are a food source for human beings. They are all interdependent.

There are so many resources that you have learnt in Grade 7. You have also learnt that these resources are of different types. Some are renewable (can be replaced and used again) while others are non-renewable (cannot be replaced/ used only once and is gone).

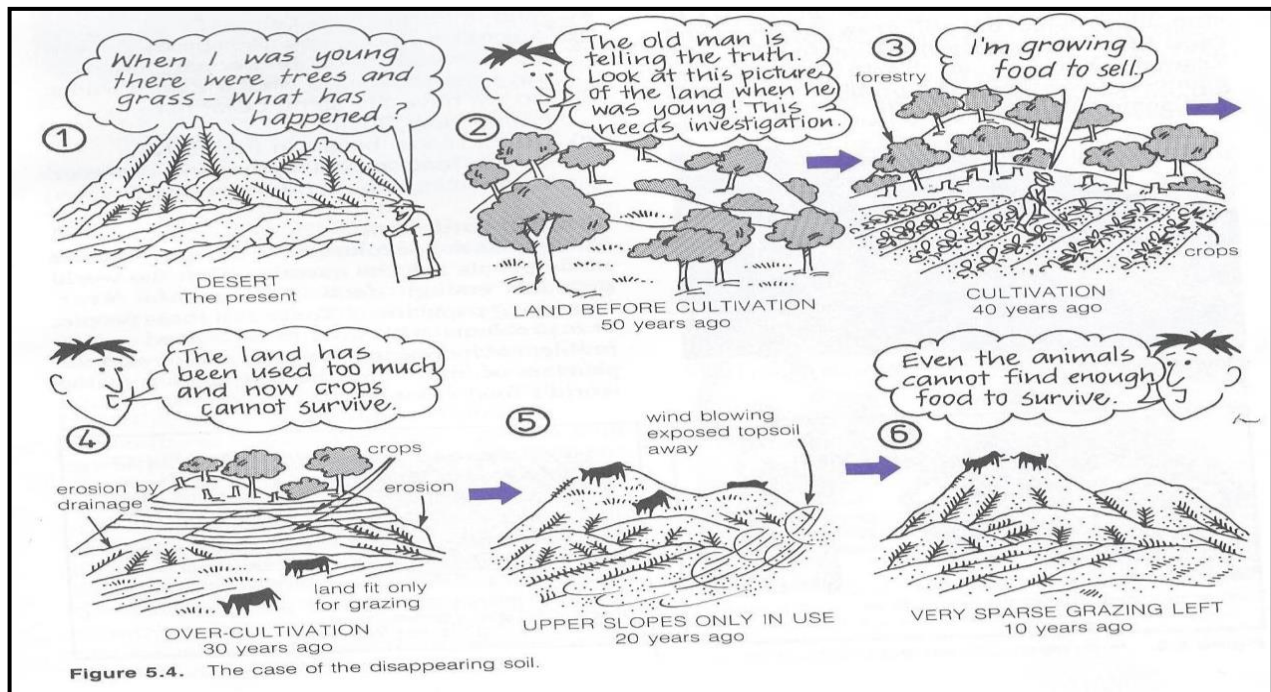
Here, we will only study the **main resources** of the world where people need the most to live.

- **Land**

Land is a valuable resource and the future of people on earth is closely linked with how the land is used. All the other resources which you have learnt in Grade 7 come under land. From the land, we have valuable forests, minerals, cash crops etc.

Land is farmed, grazed, mined, built on or used for leisure. As the world's population continues to grow, more land will be used. Therefore, there is a greater need to protect this resource so that it is used wisely.

If the land is not used carefully, it will become completely destroyed and we lose everything on it. We must use the land in ways that do not destroy it for future generations.



• Food

Food is another kind of those valuable resources which comes from the land. It is a need which people cannot live without. The ever increasing population has posed the question as to how the world will produce enough food to feed all these people.

To feed all these people; two big problems have to be solved. That is, the problem of;

- i) increasing food production
- ii) improving the distribution of the world's food resources



These two pictures clearly show that there is **unequal distribution** of natural resources. People starve to death in some parts of the world, while others have plenty due to geographical features and other reasons.

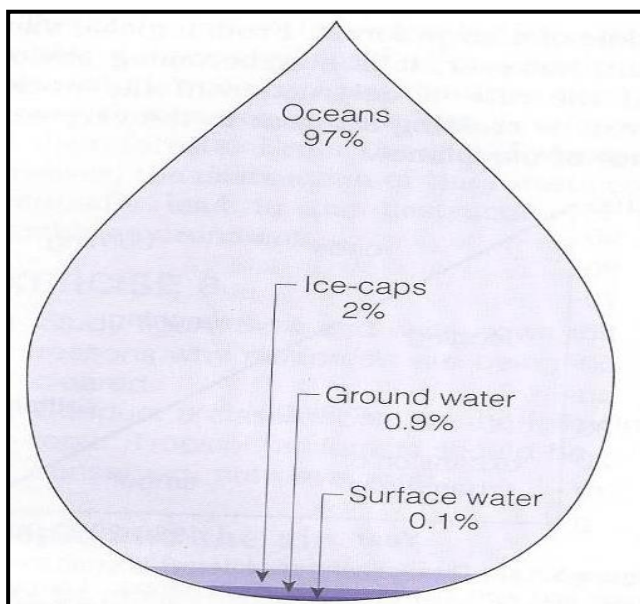
- **Water**

Water is important for life. People can live for up to two months without food but can die very quickly without water. Three-quarters (3/4) of the earth's surface is water. However, **water is a very scarce resource** because only 0.1 percent of the world's water can be used to satisfy people's needs.

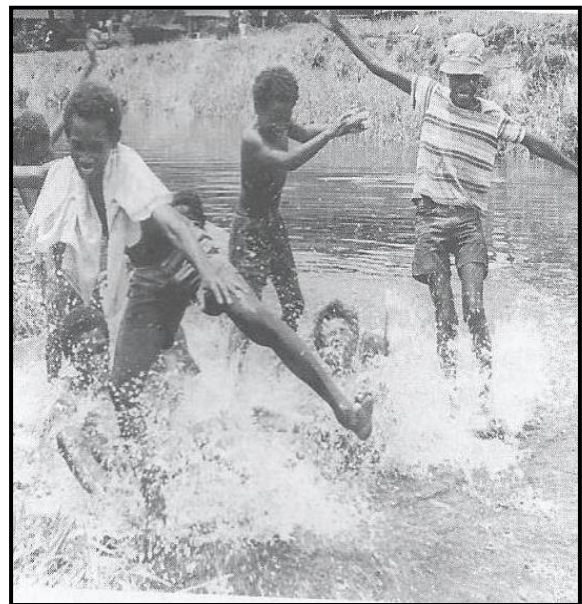
Not everyone has equal access to this 0.1 percent of water. Papua New Guineans are very lucky because water is not really a scarce resource. Many countries of the world suffer water shortages because of dry climates.

Both the quantity and quality of water are important because they affect people's health, their ability to stay clean and their ability to grow crops.

Many diseases such as typhoid, cholera and diarrhea are spread through unclean water. These diseases result in loss of working time, lack of energy and sometimes death.



Only 0.1% of the earth's water is available for people to use



In Papua New Guinea, we are lucky to have a plentiful supply of water, but we must care for it wisely

- **Air**

Nowadays almost everything we need costs us money. However, there is one basic need that is free, that is, the air we breathe. In Papua New Guinea, there is so much fresh air around us that we do not even think about it.

But, it is not the same everywhere, in developed countries, the air is polluted by gases and smoke from factories and car exhausts which causes breathing problems.

People buy oxygen masks to help them breathe when the pollution levels rise too high.

There are so many other resources but they are all part and partial of these very important resources. All other resources which you can think of come under one of these mentioned.

The impact of resource use on the physical (natural) environment

Of all the animals on earth, humans are the ones who have most impacts on their environment. All human beings use the natural environment and its resources to provide themselves with the things they need in life.

For instance;

- Forests are logged for wood which is used for many purposes from building materials to tooth picks
- Clay is taken from the ground and made into clay pots and bricks
- Stones are used for building and making roads
- Minerals taken from the earth are turned into steel and aluminum
- Oil is used for fuel
- Water is used for electricity and irrigation

Mining and forest destruction have bad effects on the environment such as soil erosion, landslides, desertification, loss of soil fertility, pollution of rivers, extinction of wildlife (ecosystems) and others. Moreover, it may also lead to climate change.

With these resources being used, the natural environment of the earth is constantly changing. This affects and changes the world's human and cultural environments.

The impact of resource use on Human Settlement Patterns

Due to the above mentioned problems, people move away from these areas. They look for better places to settle.

As more and more of the world's people live in cities, both the human and natural environments are changed by the concentration of buildings and people.

Again the natural vegetation is cleared to make way for housing and industry. Swamps are filled in to create living space. New land is created from rubbish tips such as the well-known Baruni dump in Port Moresby. People begin to settle along coastlines.

Therefore, it can be concluded that more people are moving into towns and cities and settling where they think is appropriate for them.

However, as over-crowding increases, the human environment changes too, and crime and pollution increases.



Summary

You have come to the end of lesson 21. In this lesson, you have learnt that:

- natural resources refer to things that are useful to humans' survival
- the main natural resources which covers all others are; the land, water, food and the air.
- all other resources such as forest, minerals, fisheries, etc. come under one of the main resources.
- the use of natural resources has a greater effect on human settlement.
- unwise use of natural resources leads to people moving away from their homes to live in other places.
- people have begun to settle along coastlines, towns and cities and where they think life is better.
- it is our carelessness to overuse land, exploitation of forest or clear- fell logging, open pit- mining, overfishing, polluting river systems and air that will have an effect on the future generation.
- each and everyone have a major responsibility to look after and take care of our natural resources.

NOW DO PRACTICE EXERCISE 21 ON THE NEXT PAGE



Practice Exercise 21

1. Complete this table by writing two disadvantages of each human activity.

Human Activity	Disadvantages
Clear of forest (logging)	i) ii)
Mining Minerals	i) ii)
Over Fishing	i) ii)
Factories and Burning Fossil Fuels	i) ii)

2. Collect as many pictures as you can on the human activities which have led to the destruction of the natural resources and paste them on a chart. Think of ways you, as an individual can do to help and write beside each picture.
-

CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 3
--

Lesson 22: Distribution of Natural Resources



Welcome to lesson 22. In the previous lesson, you have studied natural resources and their importance to the physical environment as well as human settlement patterns. Now, in this lesson we will learn about how these very important resources are shared out to all parts of the world.



Your Aims:

- examine the reasons for unequal distribution of the world's natural resources
- identify and discuss the effects of unequal distribution of the world's natural resources

Let us revisit the meaning of resources. Resources are materials found in the environment that humans use for food, clothing and shelter. These include water, soil, minerals, vegetation, animals, air and sunlight. People require resources to survive.

Unequal Distribution

As we have learnt earlier, our natural resources are very limited and it cannot satisfy the needs and wants of everyone in the world. The basic natural resources such as, water, air, food and land are also scarce in some parts of the world. Therefore,

Unequal distribution means that some parts of the world have very limited natural resources while others have plenty.

If you look at some countries in Africa, people starve to death. They do not have enough food and water. However, in Papua New Guinea, we have plenty of food and more fresh water.

So, now you can see what unequal distribution of natural resources means. Not everyone in the world have equal share of the world's natural resources. Any one place may be rich in the resources people desire and poor in others.

But, why do you think, there is unequal distribution of the world's resources? There are certain factors which contribute to the unequal distribution of natural resources.

i) Geographical Setting

Due to the geographic features of places in the world, for instance, places close to the equator receive more of the sun's energy and a lot of rainfall. In those areas there is fertile soil, timber and abundant wildlife. The plains offer flat landscape and fertile soil for growing crops.

However, there are places located further away from the equator, such as the poles. They receive less of the sun's energy and too little rainfall. It is extremely difficult to cultivate these lands.

Places with steep mountains and dry deserts are more challenging. It is often hard to cultivate the land.

ii) **Industrialisation**

Industrialisation refers to the time when industries began to arise/operate.

Businesses started to manufacture and produce goods. As more and more factories were built to produce and manufacture goods, the demand for resources increased. This has enabled people from developed countries to explore the world to look for raw materials for their factories, which is known as **colonialism**.

Colonialism is when a strong and powerful country takes control over a weaker country. For example, Australia taking control of Papua New Guinea.

In doing so, the colonisers (powerful countries) exploited (used our resources selfishly) to make huge profits for themselves. They had no concern for the native people and took as many resources as they could. Such action has left the native country with nothing, even to this day.

This is how industrialised (developed) nations such as Europe, Japan and United States came to control and profit from most of the world's resources. They have access to so many goods and services, i.e. they consume more of the world's resources and enjoy a higher standard of living and most of the world's wealth.

While developing countries (non-industrialised) like those in Africa, Latin America and Asia consume fewer of the resources they need for survival and well-being. Their lives are characterized by poverty and a low standard of living.

The following outlines the effects of unequal distribution of the world's natural resources:

i) **Human Settlement and Population Distribution**

People tend to settle in places that have the resources they need to survive. This results in overpopulation.

ii) **Human Migration**

Large groups of people migrate, to places that have the resources, they need or want. They move away from places that lack these resources.

iii) **Economic activities**

Economic activities in a region relate to the resources in that region. More resources mean a lot of cash flow and fewer resources, less cash flow. Economic activities that are directly related to resources include; farming, fishing, logging, oil and gas production, mining and tourism.

iv) **Trade**

Countries may not have the resources that are important to them but can acquire them through trade. Trade helps countries to get what they do not have in their country but they badly need them.

v) Conquest, conflict and war

Many historical and present-day conflicts involve nations trying to control resource-rich territories. For example, the desire for diamond and oil resources has been the root of many armed conflicts in Africa.

vi) Wealth and Quality of Life

The well-being and wealth of a place is determined by the quality and quantity of goods and services available to people in that place. This measure is known as standard of living. Because natural resources are a key component of goods and services, standard of living also gives us an idea how many resources the people in a place have.

It is important to understand that while resources are very important, it is not the presence of or lack of natural resources within a country that makes a country prosperous. In fact, some of the wealthier countries lack natural resources, while many poor countries have abundant resources.

So what does wealth and prosperity depend on?

- What resources a country has access to? (What resources they can get?)
- What the country does with them? (efforts and skills of workers, technology available for making the most of those resources)

**Summary**

You have come to the end of lesson 22. In this lesson you have learnt that:

- natural resources are important because people need them to survive.
- the natural resources of the world are unequally distributed.
- resources are unequally distributed due to the fact that, the geographical setting and climate do not allow for the perfect arrangement of the earth's resources.
- industrialisation has had a great impact on the redistribution of the world's natural resources.
- unequal distribution of the world's natural resources has had great effect on the lives of people.
- countries may have abundant of resources but they do not have the skills and technology that they need to change these resources to satisfy their needs and wants.
- other countries do not have or very few resources but they have the necessary skills and technology to change them into useful things to satisfy their needs and wants.

NOW DO PRACTICE EXERCISE 22 ON THE NEXT PAGE



Practice Exercise 22

1. Make a list of all the natural resources we have here in, Papua New Guinea.

For Questions 2 & 3, look at newspapers, listen to news or ask around to find your answers. Information is not given in the reading in lesson 22.

2. Which province is leading in the production of oil and gas?

3. Which company is involved in the extraction of gas in the province you named above?

4. Why are natural resources important?

5. Why do you think Papua New Guinea's standard of living is very low even though, we are rich in natural resources?

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 3

Lesson 23: Addressing Environmental Issues



Welcome to lesson 23. You have studied the distribution of natural resources in lesson 22. You will now learn about environmental issues.



Your Aims:

- define and provide examples of environmental issues.
- identify some of the environmental issues affecting the world today.
- identify organisations that address environmental issues.
- report on the work of an organisation addressing environmental issues.

What are environmental issues?

Environmental issues are factors affecting the environment. The surroundings, for example, the nature of the living space like the sea or land, soil or water, climate and other organism (plants and animals) present.

Human activities such as hunting, fishing, forestry, mining, transport and development of urban areas are affecting the number of animals and plants that will survive in to the future by changing their natural environment.

Let us look at the factors that affect the environment.

Pollution - What is pollution?

Pollution is anything introduced into the environment that damages the environment. Any pollution that changes the environment can also threaten the survival of plants and animals. The three main pollutions include **soil pollution**, **water pollution** and **air pollution**.

1. **Soil pollution** for example, includes the dumping of rubbish like plastic that cannot be broken down (biodegradable) to become part of the soil.



2. **Air pollution** from smoke, exhaust gases that is (gases left over from the burning of diesel or petrol by engines) from cars and other means of transport and waste gas and smoke from industry (this is also a problem to global warming).

3. **Water pollution** from chemical wastes from industry, mining, farming (fertilizers and insecticides), oil, detergent, and human sewage (human waste). This can seriously affect oceans, where scientists are worried about dead zones where there is no oxygen for fish.

The oxygen is lost when algae (plants that grow in water, with no true stems or leaves) grows in the nitrogen that comes from water pollution. Rivers and ocean water can also be heated by the release of hot water from industry. This makes the water too hot for plant and animal life to survive.

People can affect the plants and animals, the rivers and the seas of Papua New Guinea. They can work with the environment to improve it or to damage it.

What are the effects of these environmental issues?

1. Soil pollution – no proper growth for plants etc.
2. Air pollution – destroying the ozone layer that leads to global warming.
3. Water pollution – killing marine life and also human lives are in danger.

We have just looked at the three main pollutions that affect the environment. Actions can be taken to stop such pollutions. Such actions can be global or there can be campaigns to address sustainable use of resources and how they could be applied to Papua New Guinea.

For example, green peace campaigning for an international treaty banning harvesting of young dugongs etc., conservation international campaigning for an international banning harvesting of young fish, shellfish, beech dame and other marine resources and so on.

Here are examples of groups and organisations that address environmental issues:

- Green peace
 - WWF- World Wildlife Fund
 - CI – Conservation International
 - Environment and Conservation
-



Summary

You have now come to the end of lesson 23. In this lesson, you have learnt that:

- environmental issues are factors affecting the environment.
- human activities such as hunting, fishing, forestry, mining transport and development of urban areas are affecting the environment.
- pollution is anything introduced into the environment that spoils the environment.
- the pollution can be soil, air or water pollution.
- global actions or campaigns addressing sustainable use of resource.
- groups or organisations that address environmental issues are; Green Peace, WWF, Conservation International, Environment and Conservation.

NOW DO PRACTICE EXERCISE 23 ON THE NEXT PAGE



Practice Exercise 23

1. What are environmental issues?

2. List down 3 examples of human activities affecting the environment.

3. What does pollution do to the environment?

4. Explain the role of Green Peace?

5. Are all these groups or organisations that address environmental issues government bodies?

6. Why these groups or organisations are called NGO'S or Non – government organisation?

CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 3
--

SUB-STRAND 3**ANSWERS TO PRACTICE EXERCISES 21 - 23**

Practice Exercise 21

1.

Human Activity	Disadvantage
Clear of forest (logging)	i) extinction of wildlife ii) soil erosion
Mining Minerals	i) river pollution when dumping waste into rivers ii) soil erosion
Over Fishing	i) extinction of fish species ii) no income for country in future for fish resources
Factories and Burning Fossil Fuels	i) Air pollution ii) Increases global warming

Practice Exercise 22

1. gold, copper, timber, fish, tea, coffee, vanilla, cocoa, copra and cattle.
 2. Hela Province
 3. Exxon Mobil
 4. Because people need the resources to survive.
 5. Papua New Guinea needs the skills and knowledge as well as Technology (machinery) to change the raw materials into finished goods and services to satisfy people's needs and wants.
-

PRACTICE EXERCISE 23

1. Environmental issues are factors affecting the environment like soil, water and pollution.
 2. i. Hunting ii. Fishing iii. Mining
 3. It damages/spoils the environment.
 4. It campaigns for an International Treaty banning/stopping people from harvesting young dugong and others.
 5. No, not all are government bodies, most are non – government organisations (NGO'S).
 6. They are called NGO'S because they are not funded by the government.
-

SUB-STRAND 4

WORKING TO SUSTAIN

THE PHYSICAL ENVIRONMENT

In this sub-strand you will learn about:

- **Renewable and Non- Renewable Resources**
- **Renewable and Non-Renewable Energy Resources**
- **Sustainable Use of Renewable Resources**

SUB-STRAND 4

Working to Sustain the Physical Environment

In this sub-strand, you will learn about renewable and non-renewable resources.

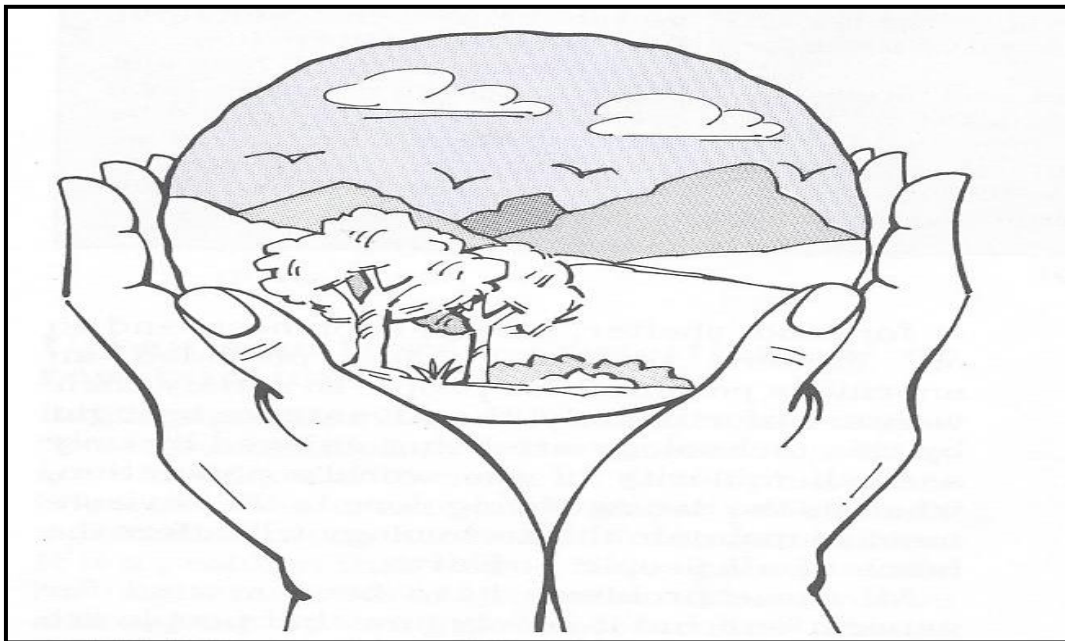
Renewable resources are natural resources which can be replaced in a short period while non-renewable resources are those that take millions of years to form.

Therefore, you will study the ways people use to try to control and monitor the use of natural resources in the physical environment. It is very important to educate people everywhere about the importance of our natural resources in the physical environment.

You as an individual, have a responsibility to take care of our resources, for instance, planting a tree.

After studying these ways, we will go out and educate others about the importance of our natural resources and practice sustainable use of these resources.

The Future of the Earth Is In Our Hands



Lesson 24: Renewable and Non - Renewable Resources



Welcome to lesson 24 of Sub-strand 4. In lesson 23, you have learnt about the environmental issues affecting our natural resources and ways to minimise this problem. In this lesson, we will learn about renewable and non- renewable resources.



Your Aims:

- define renewable and non-renewable resources
 - identify examples of renewable and non-renewable resources
 - investigate the impact of exploitation of natural resources
-

Firstly let's define the word renewable and non-renewable resources.

Renewable resources are resources that are harvested and can be replaced.

Non-renewable resources are resources that cannot be replaced when harvested or removed from the environment completely.

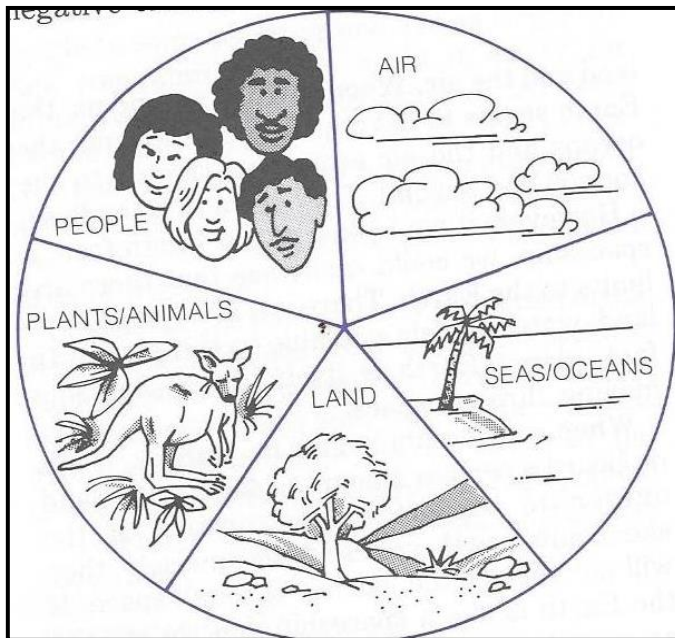
Here are examples of renewable and non- renewable resources

Renewable	Non - Renewable
Forest	Oil
Water	Gold
Soil	Copper
Air	Gas

The importance of natural resources

There is **interdependence** (living things depend on each other) between the natural resources and the people. Without natural resources, humans cannot survive. All the parts of the earth fit together. The living things interact with one another with their environment. They are interdependent. If one part is changed, it affects all the others. When changes occur, they can be positive and negative effects.

Take a look at the diagram below. It explains why natural resources are important.



Imagine if there were no plants! People will suffocate and die because plants take in carbon dioxide and give off the oxygen which we breathe.

Let us look at the land; the land is the good mother of everything. Without the land, we would have no food to grow and eat.

Look at the seas and the oceans, major sources of food and transportation.

Therefore, the important point here is, all living things depend on each other. Without the presence of one will have big effects on others.

The impact of exploitation of Natural Resources:

With these resources being used, the natural or physical environment of much of the earth is constantly changing and this in turn affects and changes the world's many human and cultural environments.

For example;

- **Logging of Forests**

- i) Causes soil erosion because the soil is left bare without any cover to keep it safe from the rain. When heavy rain falls, it washes away the soil which may result in mass landslides.
- ii) Removing the forest means, destroying the home of wildlife (ecosystem). Some species of plants (bush medicine) and animals that live there will become **extinct (die out)** or run away from there.

- **Mining**

- i) This activity also destroys forests which results in the problems mentioned above.
- ii) Mining companies dump their chemical waste into rivers which is dangerous for the living things in the rivers. It is poisonous for people to use too. If and when they use the polluted river, they are likely to develop all sorts of diseases. It is also dangerous for humans to catch fish from the river for consumption.
- iii) The soil after the mining company leaves has no nutrients for cultivation. It becomes useless for people to settle and make gardens. This may result in the area becoming a desert.

- **Overfishing**

- i) Shortage of fish stock because no time is given in between for the fish to reproduce
- ii) Drift-net fishing has not made way for the young ones to escape so again there will be a shortage of fish if nothing is done.

Apart from these there are also many others that affect people.



Summary

You have come to the end of lesson 24. In this lesson you have learnt that:

- renewable resources can be replaced.
 - nonrenewable resources cannot be replaced when used.
 - Forests are logged for wood, buildings and toothpick.
 - clay is used for cooking pots or bricks.
 - stones are used for buildings and for road making.
 - minerals are turned into steel and aluminum.
 - oil is used for fuel and turned into plastic.
 - water is used to supply cities and agriculture.
 - earth is the greatest natural resource.
 - air, land and water combine to create environment.
 - land covers one third of earth's surface.
 - water covers two thirds of the earth's surface.
-

DO PRACTICE EXERCISE 24 ON THE NEXT PAGE



Practice Exercise 24

1. Write down the difference between renewable and non -renewable resources.

2. Below is a list of renewable and non - renewable resources. Write them under the correct headings in the table.

Word list: flowers, coal, trees, gold, copper, water, diamond, grass

Renewable	Non – renewable

3. Explain the importance of natural resources.

4. List down two examples of impacts of exploitation of natural resources

i) _____

ii) _____

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 4
--

Lesson 25: Renewable and Non Renewable Energy Resources



Welcome to lesson 25. In the last lesson, you learnt about renewable and non-renewable resources and the impact of exploitation of natural non-renewable energy resources. In this lesson you will study energy resources.



Your Aims:

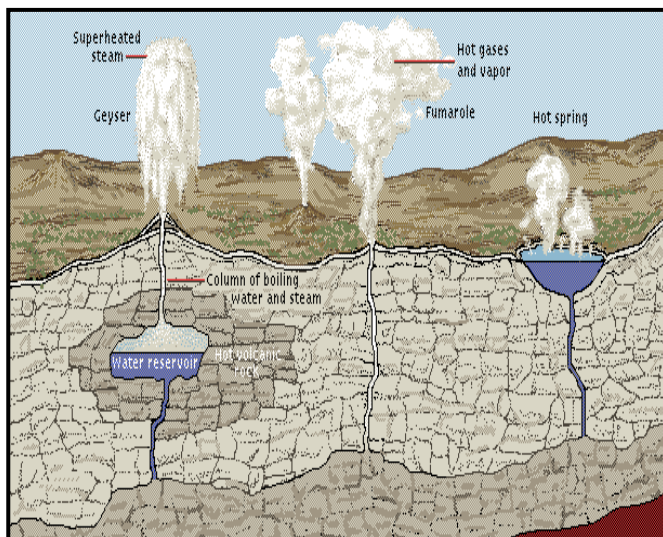
- define renewable and non-renewable energy.
- identify examples of renewable and non-renewable energy resources.
- discusses the advantages and disadvantages of different energy resource

What is renewable energy?

Renewable energy is naturally generated energy source. This energy is obtained from the sun, wind, waves, water, geysers or hot springs. Renewable energies are sustainable, does not harm the environment and cost less.

The following photographs show some examples of renewable energy.

1. Geysers or Hot Springs



Geothermal energy, an aspect of the science known as Geothermic, is based on the fact that the earth is hotter the deeper one drills below the surface.

Water and steam circulating through deep hot rocks, if brought to the surface, can be used to drive a turbine to produce electricity or can be piped through buildings as heat.

Geysers, hot springs, volcanoes and fumarole produce **geothermal energy**.

2. Solar Energy (Sun)



Solar Panels on the roof

This photograph shows solar panels mounted onto the roof to trap sun's heat which is then changed into electricity to power electrical appliances in the house.

Solar energy is effective in areas closer to the equator where sunlight is intense.

3. Water



Water power, power derived from the fall of water from a higher to a lower level, and extracted by means of water-wheels or hydraulic turbines.

This then produces electricity to power electrical devices.

Water power is a natural resource, available wherever a sufficient volume of steady water flow exists.

4. Wind



Windmill is a machine that converts (changes) wind into useful energy. This energy is derived from the force of wind acting on blades or sails that radiate from a shaft.

The turning shaft may be connected to machinery used to perform such work as milling grain, pumping water, or generating electricity. When the shaft is connected to a load, such as a pump, the device is typically called a windmill. When it is used to generate electricity, it is known as a wind turbine generator.

What is a non-renewable energy?

Non-renewable energy is one that cannot be renewed and is obtained from fossil fuels such as coal, oil and gas.

The world economy needs energy resources to grow. Oil (petroleum) and natural gas are two very important fuels that provide energy for transportation on land, sea and in the air.

Coal is another important natural resource that is used to create electricity. Oil, gas and coal have been produced over millions of years but they are not renewable. One day they will run out.

Presently, the world still depends on oil, gas and coal for most of its energy. The biggest problem with alternative energy is the cost, the non-renewable fuels cost less.

Currently, no one has to pay for the damage they cause to the environment or the carbon dioxide they release into the atmosphere, but this is now changing.

Photographs below show some processes in abstracting fossil fuels.



Petroleum, or crude oil, naturally occurring oily, liquid composed of various organic chemicals.

It is found in large quantities below the surface of the earth and is used as a fuel and as a raw material in the chemical industry.

It is the primary source of energy for sea, land and air transport.

In addition is also used in the manufacture of medicines and fertilizers, foodstuffs, plastics, building materials, paints, and cloth and to generate electricity.



Natural Gas is a

flammable gaseous mixture consisting mostly of hydrocarbons (chemical compounds that contain carbon and hydrogen).

Along with coal and petroleum, natural gas is a fossil fuel.

Natural gas, which is found together with petroleum deposits in earth's crust, is extracted and refined into fuels that provide approximately 25 percent of the world energy supply.

Coal is an organic rock composed primarily of carbon, hydrogen, and oxygen. Coal is burned to produce energy and is used to manufacture steel.

It is also an important source of chemicals used to make medicine, fertilizers, pesticides, and other products.

Coal comes from ancient plants buried over millions of years in earth's crust, its outermost layer.

Coal, petroleum, natural gas, and oil shale are all known as fossil fuels because they come from the remains of ancient life buried deep in the crust.

Here are some examples of renewable and non-renewable energy resources.

Renewable	Non renewable
Wind energy	Natural gas
Tide	Fossil fuels
Waves	Coal
Solar (sun)	Oil

This table shows the renewable energy source, where and how it works and the problems it creates in an environment.

Renewable energy source	Where and how it works	Problems
Hydro	Water power – water is collected in dams and used to drive turbines to produce electricity. (People used simple water power for centuries in water mills that ground up wheat and other cereals.)	Dams will eventually fill up with silt. They impact on stream flow and fish migration. People have to leave their land when construction of a dam floods it.
Solar	Sun power – solar panels can heat water and charge batteries but solar energy needs to become more efficient to produce a lot of power. (Plants have used solar energy for millions of years.)	The technology is still very new and works best in warm, sunny climates but not as well in colder regions.
Wind	Wind power – wind can be used to drive turbines in wind farms to produce electricity. (Windmills, like water mills, were used to grind grain for hundreds of years.) Denmark is a leader in this field.	Windmills need a constant supply of wind so wind farms may be situated far from where the energy is needed. Windmills can be a hazard for birds. They can be noisy and unattractive.
Bio fuels and biomass	Alcohol produced from crops such as corn and sugar cane to use as fuel – this is happening in some places like Brazil and the USA.	High-value crops are required so this process can be costly. In poor countries, there is the question of best use of the land for the nation.
Geothermal	Ground heat – the deeper you go beneath the surface of the Earth, the hotter it gets. Heated water from natural or introduced water sources can be used to drive turbines to produce electricity. New Zealand is a leader in this field.	Areas of the world where heated water is being pushed to the surface tend to be unstable. The technology is still experimental.
Tidal	Water power – in some places, the tide may rise three to four metres. This force can be used to generate electricity.	The technology is still experimental. Corrosion and storm damage are constant hazards of the sea.
Nuclear	Nuclear power – a proven technology that can produce power. It is used in the USA and Europe.	Nuclear power produces toxic waste that takes thousands of years to break down. Nuclear accidents can poison the environment and kill people. Nuclear technology may also lead to producing materials for nuclear weapons.

There are advantages and disadvantages of renewable and non-renewable energy resources. Some examples are shown in the table.

Energy type	Advantage	Disadvantages
Solar	- renewable - free	- cannot work in cold regions
Coal, oil, gas	- easy to develop	- major polluters, long time to form. - expensive - will run out in future
Tidal	- renewable - free	- damages the environment.

It has been estimated that the world annually consumes an amount of fossil fuels that took nature 1 million years to produce and that the rate of consumption increased four – fold between 1950. This consumption of energy is not evenly distributed over the globe (world).

Coal, oil and natural gas which account for an estimated 87.8 percent of the global energy used in 1990 are forms of stored energy produced over thousands of years by photosynthesis in green plants.



Summary

You have come to the end of lesson 25. In this lesson you have learnt that:

- renewable energy is naturally generated energy source.
- renewable energy resources can be replaced or do not run out such as; solar energy, energy from the wind, rivers and even waves.
- renewable energies are sustainable, does not harm the environment and cost less.
- non-renewable energy resources cannot be replaced but they will run out in future if not used wisely. For example, coal, oil, gas or fossil fuels.
- fossil fuels are extracted from underground by mining.
- coal is another important natural resource.
- the world depends on oil, gas and coal for most of its energy.
- world economy needs energy resources to grow.
- oil (petroleum) and natural gas are two very important fuels which provide energy for transportation (land, sea and air).

NOW DO PRACTICE EXERCISE 25 ON THE NEXT PAGE



Practice Exercise 25

1. Fill in the missing words in the paragraph below.

Oil, gas and coal have been produced over _____ of years but, they are non - renewable, one day, they will _____ out. Presently, the world still _____ on oil, _____ and coal for most of its _____.

2. Write down three examples of renewable and non-renewable energy resources.

Renewable	Non renewable

3. How is coal formed?

4. Write down one of the problems caused by nuclear energy?

CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 4
--

Lesson 26: Sustainable Use of Natural Resources



Welcome to lesson 26. In the last three lessons, you learnt about resources in the environment and how these resources are used. In this lesson, we will learn about the sustainable practices to take care of the environment.



Your Aims:

- define sustainable
- identify examples of sustainable practices in different parts of the world
- identify global examples of how environmental damages are being addressed

Before we look at sustainable use of resources, let us first define **sustainable**.

Sustainable refers to any development activity that is able to continue on without doing any damage to the environment.

Sustainable use of natural resources

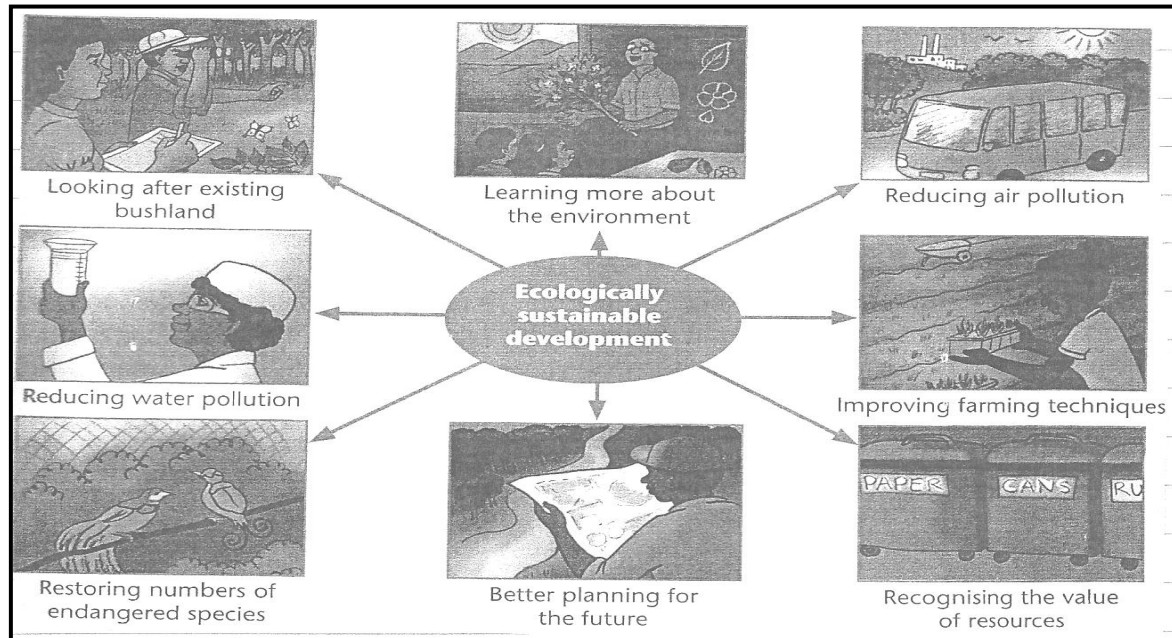
The growing world population puts more pressure on natural resources. People everywhere are trying to improve their economies and lifestyles. This uses up more resources. Recycling and careful use of resources are two ways that help protect them. Improved technologies can also sustain resources and find new ones.

Both the land and sea hold many life forms that we still do not know about. Science has recorded about one and a half million living species. But there may be another 28 million species still to be recorded.

As we use the earth, we must think of protecting our environment and its wildlife. **Ecologically sustainable development is all about using the land and its resources in such a way that we do not destroy it.** People need to take action to achieve sustainability. This may mean replacing forests by replanting trees, setting aside areas of natural importance as conservation reserves or placing restrictions on the way people can use the natural environment.

Education is an important medium through which people can be made aware of the dangers posed on the environment and the sustainable ways of using the environment.

WAYS TO PROTECT THE ENVIRONMENT



Here are some examples of sustainable agricultural practices in different parts of the world.

i) **Crop rotation** – planting different crops on different plots each season.

Why do we practice crop rotation?

- It helps to keep the soil fertile (full of nutrients)
- It helps to control pest and diseases.
- It is a good way of growing better crops without having to spend money on fertiliser and pest control products.

ii) **Avoid slash and burn** – cut grass under woods and allow it to dry on the ground. This will mulch and protect the soil until you are ready to plant crops.

iii) **Mixed cropping** – planting different kinds of crops in one area at the same time.

Below are examples of ways we can consider to minimise the damage we do to the environment.

- **Mines**

- Keep mine waste on the land
- use nets to stop mine waste from spreading out

- **Sewage**

- Treat sewage before it is released into the sea.
- Prevent industrial waste entering the sewage system
- Not using chlorine to disinfect the water supply.
- Conserving water.

- **Logging**

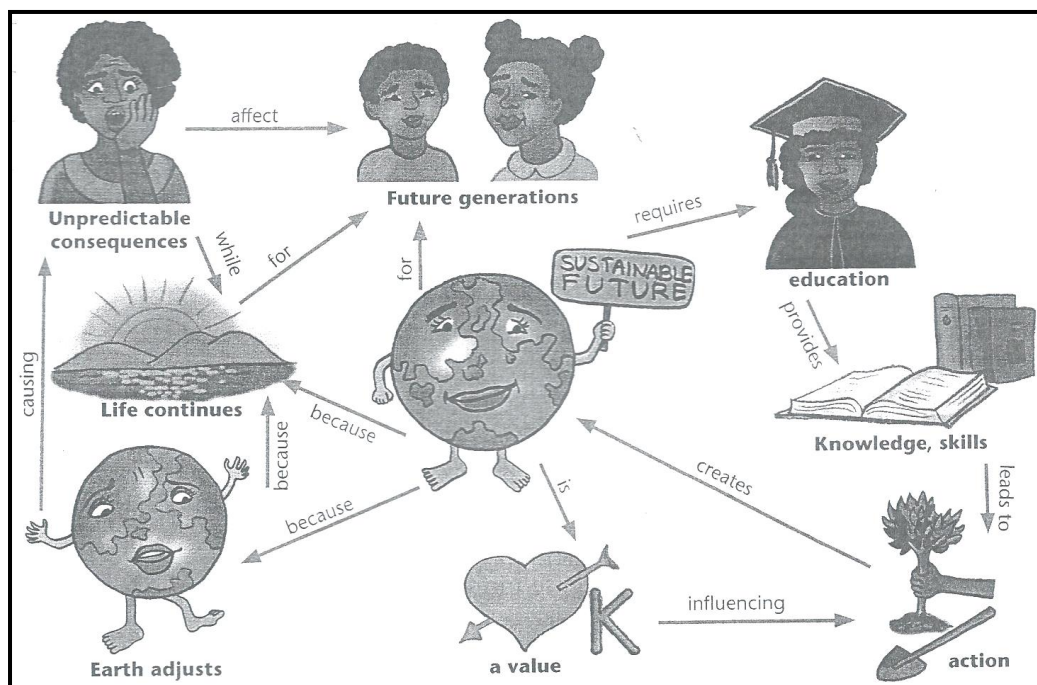
- Replanting of trees that are cut down.(Reforestation)
- Keep waste on the land.

The United Nations Environment Program (UNEP) suggests some ways we can help, such as:

- cooperating to find the best technology for sustainable environments and use that technology all over the world.
- using energy efficiently and use renewable energy resources.

Animals and plants can be preserved by setting aside special areas for them to live. Laws can be made to protect animals against hunters. Laws can also control where mining and logging can happen. Look at this **concept map** (a way of showing that ideas are connected).

A Sustainable Future



Think Globally, Act Locally

All environments are connected. If we act to protect our local areas, then we are helping to protect the global environment. In Papua New Guinea, there are government policies and non-government organisations (local and overseas) that work to protect Papua New Guinea's environment. We also belong to the Pacific environment and beyond that to the world environment. If the world wants to achieve sustainable development there must be cooperation between people all over the world.

Change is needed to achieve a balance between population and resource use. Our rapidly increasing population means we put pressure on the environment when we use more of its resources especially, if we do not replace them. Several countries with large and quickly growing populations, such as China and India, have tried to reduce their population growth and have policies that encourage people to have smaller families.

The other way is to reduce the amount of resources used by the population. We can do this by using or consuming less, re-using things and recycling our waste products. For example, we can take less from the environment, such as trees for paper and cardboard and metal for cans. If we do this, we produce less waste and then less space is needed for rubbish tips and there is less pollution.

We can also develop fuel resources that do not come from non-renewable sources. Examples are wind, solar and tidal power. These fuels use parts of our environment that renew themselves naturally and do not give out gases which pollute the environment or cause the greenhouse effect. For example, solar energy can be used to make electricity and can be used to replace other sources of electricity such as diesel power stations which pollute the atmosphere.



Summary

You have come to the end of lesson 26. In this lesson you have learnt that:

- sustainable refers to any development activity that is able to continue on without doing any damage to the environment.
- the growing world population puts more pressure on natural resources.
- recycling and careful use of resources are two ways of help protect them.
- as we use the earth we must think about protecting our environment and its wildlife.
- ecologically sustainable development is all about using the land and its resources in such a way that we do not destroy it.

NOW DO PRACTICE EXERCISE 26 ON THE NEXT PAGE



Practice Exercise 26

1. What are the two ways that help to protect resources?

i) _____

ii) _____

2. How can education help us to sustain our environment?

3. Write two (2) examples of sustainable practices in a school.

i) _____

ii) _____

4. What do these UNEP initials stand for?

5. Why are rules or policies made to protect plants and animals?

CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 4
--

SUB-STRAND 4

ANSWERS TO PRACTICE EXERCISES 24 – 26

Practice Exercise 24

1. Renewable resources can be replaced after harvested whereas non - renewable resources cannot be replaced when harvested or taken out of the environment.
- 2.

Renewable	Non – renewable
flowers	coal
trees	gold
grass	copper
water	diamond

3. Natural resources are very important because all living things depend on them, for example:
 - ✓ Forests – natural habitat for animals, source for obtaining building materials, traditional medicine, etc.
 - ✓ Water – producing electricity, irrigation for agriculture, means of transportation, etc.
 4. i) Mining – environmental damage caused by waste or tailings to river systems.
 ii) Logging – deforestation which leads to the extinction of wildlife.
-

Practice Exercise 25

1. millions, run, depends, gas, energy
- 2.
3. Coal is formed from the remains of dead plants and animals buried millions of years ago before they rot completely.
4. Nuclear accidents can cause air pollution which is dangerous to people and animals because they breathe in the polluted air.

Renewable	Non - Renewable
Wind, waves	Coal
Tide, sun	Oil
Water, geysers	Gas

Practice Exercise 26

1.
 - i) recycling
 - ii) careful use of resources
 2. Educate others who cannot read and write about the importance of sustainability
 3.
 - i) putting rubbish in the rubbish bins
 - iii) planting flowers and trees in the school grounds
 4. United Nation Environment Program
 5. Rules and policies are made to protect plants and animals so that they are not over used; over using or harvesting may lead to extinction (run –out)
-

SUB-STRAND 5

NATURAL HAZARDOUS EVENTS

In this sub-strand you will learn about:

- **Natural hazards**
- **Ozone depletion**
- **Global warming**

SUB-STRAND 5

Natural Hazardous Events

In this sub-strand, you will learn about natural hazards. Natural Hazards become hazardous when people are not prepared and they cause severe damages to properties and even deaths.

You will furthermore study ozone depletion which occurs as a result of careless human activities.

Global Warming is another of those important issues affecting the world we are living in. They are very important issues which need more attention. People are working around the clock to minimise these problems.

You will also learn about natural hazards affecting Papua New Guinea and other countries.

Lesson 27: Natural Hazards



Welcome to lesson 27. Lesson 26 was based on how we can protect our natural resources so that we do not run out in the future. In this lesson, we will learn about natural hazards, the cause and effects in other parts of the world and how people respond to them.



Your Aims:

- define natural hazards
- identify the different types of hazards
- state the causes and effects of hazardous natural events
- describe how Papua New Guinea and other countries prepare for hazardous natural events
- show the distribution of past hazardous natural events on a map

Natural Hazards - What are natural hazards?

A natural hazard is a threat of a naturally occurring event that has a negative effect on people or the environment.

Natural hazards, which include earthquake, volcanic eruption, floods, drought, fire, tsunami, landslides, avalanches, tornados, storms and many others, result from natural processes with the environment.

They are, therefore, different from environmental disasters, such as desertification, ozone depletion (reduction) and acid rain, which are caused by human activity and the management of the environment. It is important, however, to stress the difference between a **natural hazard** and a **natural event**.

Natural hazards have the potential to affect people and the environment; it is the hazard event which causes the damage. An event only becomes a hazard if it affects, or threatens **people** and **property**.

The impact of a hazard event may be felt over a wide area; the effects may be long term as well as immediate; and the event can be costly to property and dangerous to people.

Below are four examples of natural hazards, their causes and effects on the environment.

i) **Flood**

Floods caused by too much rain or water in a location are one of the most common natural disaster. Floods can be caused by prolonged rainfall from a storm, including thunderstorms; rapid melting of large amounts of snow; or rivers which swell from excess precipitation (rain) upstream and cause widespread damage to areas

downstream. Flash floods can occur without warning after intense storms. They move at great speed and can tear out trees, destroy roads and bridges and wreck buildings. Very high tides, waves driven by hurricanes or tsunamis can cause flooding of salt water onto the land some areas experience regular floods, such as parts of India and Bangladesh.



Flooding in Western Highlands



Flood victims

ii) **Forest fire**

A forest fire destroys a forested area, and can be a great danger to people, wildlife and property in or near forests. Forest fires are generally started by lightning but human carelessness causes forest fires. Thousands of square kilometres can be destroyed.

The Ash Wednesday bushfires in Victoria and South Australia in 1983 raged in about 180 different areas. Approximately 520 000 hectares of bush or grass were burnt, 3700 buildings destroyed, 76 people died and 340 000 sheep and 18000 cattle died.



Bush fire in Victoria - Australia



Destruction caused by bush fire in Victoria

iii) **Earthquake**

An earthquake is a sudden shift or movement in the tectonic plate in the earth's crust. There is usually no warning. In countries where houses and other buildings are poorly built, there can be great destruction and the most powerful earthquakes can destroy even the most expertly built structures. Earthquakes can cause other disasters such as tsunamis. Earthquakes can kill hundreds of thousands of people.

Some Recent Earthquakes

Location	Year
Spitak Armenia	1988
Kocaeli	1999
Bhuj, Gujarat, India	2001
Bam, Iran	2003
Indian Oceans, Indonesia	2004
Sumatra, Indonesia	2005
Java, Indonesia	2006

Earthquakes are different from other natural disasters because aftershocks are felt and it is hard for people to feel safe for a long time.

iv) Volcanoes

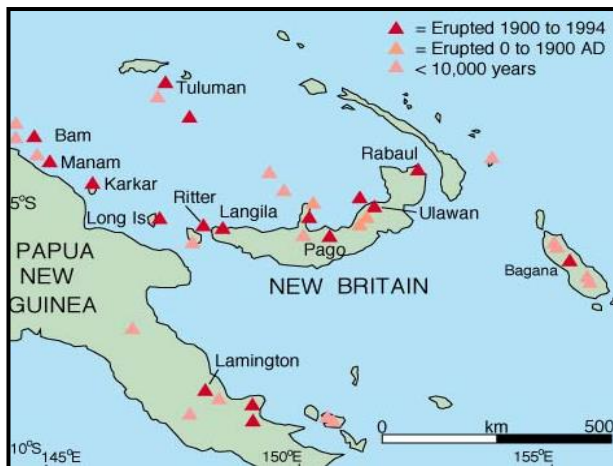
A volcano is an opening in the surface of the earth which allows hot lava, volcanic ash and gases to escape from below the surface of the earth.

Volcanoes are caused by tectonic plates colliding or diverging.

Volcanic eruptions come in many forms. They range from daily small eruptions which occur in places like Kilauea, Hawaii or extremely infrequent super –volcano eruptions in places like lake toba, Indonesia.

People can be killed by being suffocated by breathing in hot gas and ashes, crushed by buildings collapsing under ash or buried in mud flows. The natural environment is damaged by destructing of vegetation and animal life.

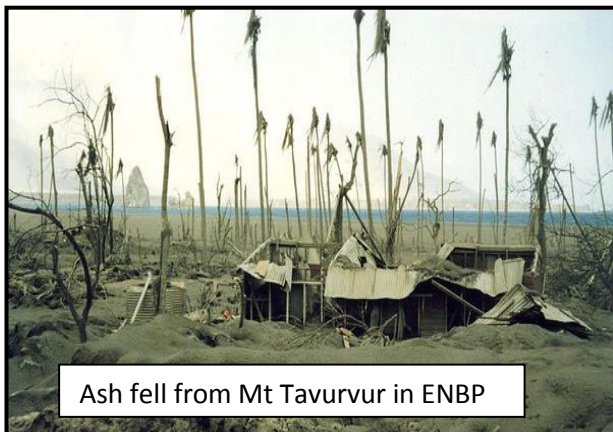
Volcano in Rabaul and destruction caused.



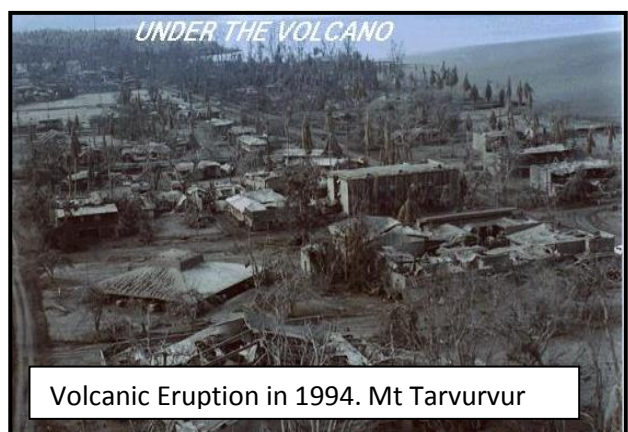
Map of Volcanoes in PNG



Mt Tavorvur in East New Britain Province



Ash fell from Mt Tavorvur in ENBP



Volcanic Eruption in 1994. Mt Tarvuvur

How many people prepare and respond to hazardous natural events?

What to do if you are near the sea and an earthquake occurs:

As soon as the shaking stops, move to high ground and stay there for about an hour.

If the sea goes out do not walk on the reefs because a tsunami is sure to occur. After the shaking has stopped the next sign of most, but not all tsunami, is a drop in sea level.

Within a few weeks of the major Pinatubo eruption in the Philippines, groups of evacuees from the area began to consider their future options and their next move.

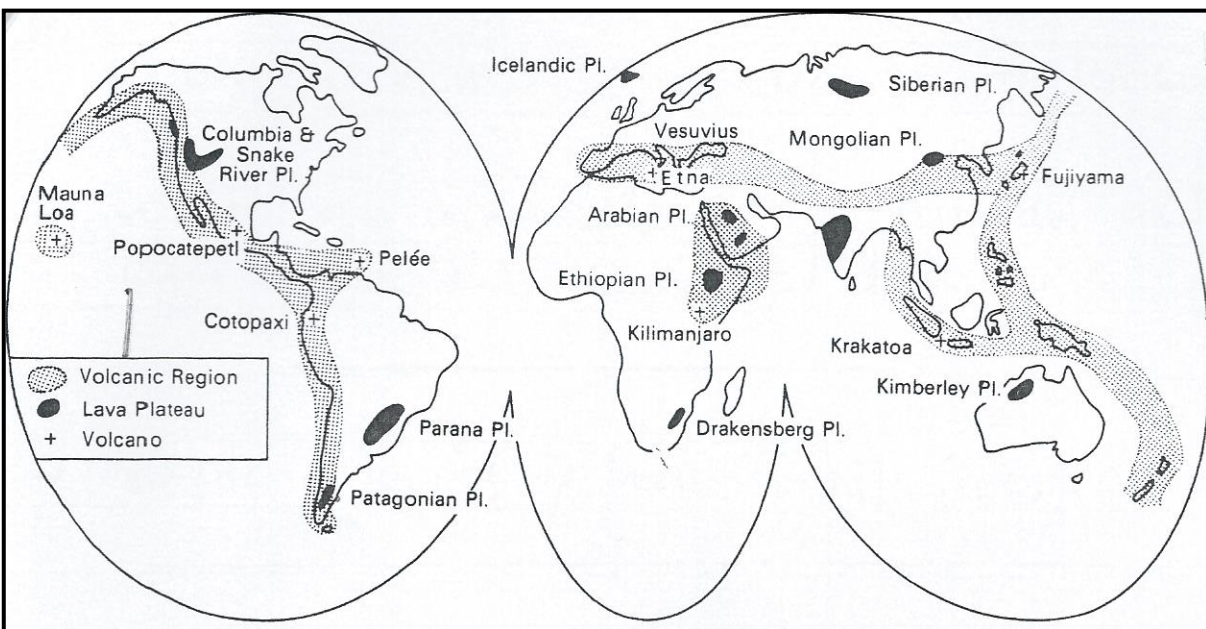
Their range of responses included the following:

Some members of the Acta tribe decide not to return to their former homes. As a spokesperson explained, “everything we have planted has been destroyed. There is no point in going back. The government will have to put us somewhere else”.

In contrast, the majority of the Acta tribe decided to return. To them, the mountain slopes, although vastly changed, were still their home and the hard way of life in the hills was preferable to the foreign habits of the lowlanders and to living in urban areas.

Most of the people who fled from the city of Angeles have, so far, opted against returning home. To them, life in the shanty refugee camp is safer than where eruptions and earthquakes are common.

The map below shows the world distribution of volcanoes and lava plateaus





Summary

You have come to the end of lesson 27. In this lesson you have learnt that:

- a natural hazard is a threat of a naturally occurring event that has a negative effect on people or the environment.
- natural hazards result from natural processes within an environment which are destructive to the environment.
- examples of natural hazards are earthquakes, volcanic eruption, floods, drought, fire, tsunamis and many others.
- environmental disasters refer to desertification, ozone depletion (reduction) and acid rain are caused by human activity.
- an event becomes a hazard if it affects or threatens people and property.
- floods are caused by too much rain and melting of snow.
- fires are caused by lighting.
- earthquakes are caused by sudden shift or movement of tectonic plates.
- volcanic eruptions are caused by pressure within the earth's interior.

NOW DO PRACTICE EXERCISE 27 ON THE NEXT PAGE



Practice Exercise 27

1. Write an example of a human activity that can cause environmental disaster.

2. Explain briefly how forest fires occur.

3. How would people prepare and respond to a natural hazard?

4. What are the effects of an earthquake?

CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 5
--

Lesson 28: Ozone Depleting



Welcome to lesson 28. The previous lesson was on hazardous natural events and how people can be prepared for them. In this lesson, you will learn about ozone depletion.



Your Aims:

- define ozone layer, ozone depletion and stratosphere
- state the importance of the ozone layer
- identify the causes and effects of thinning of the ozone layer.

Ozone layer

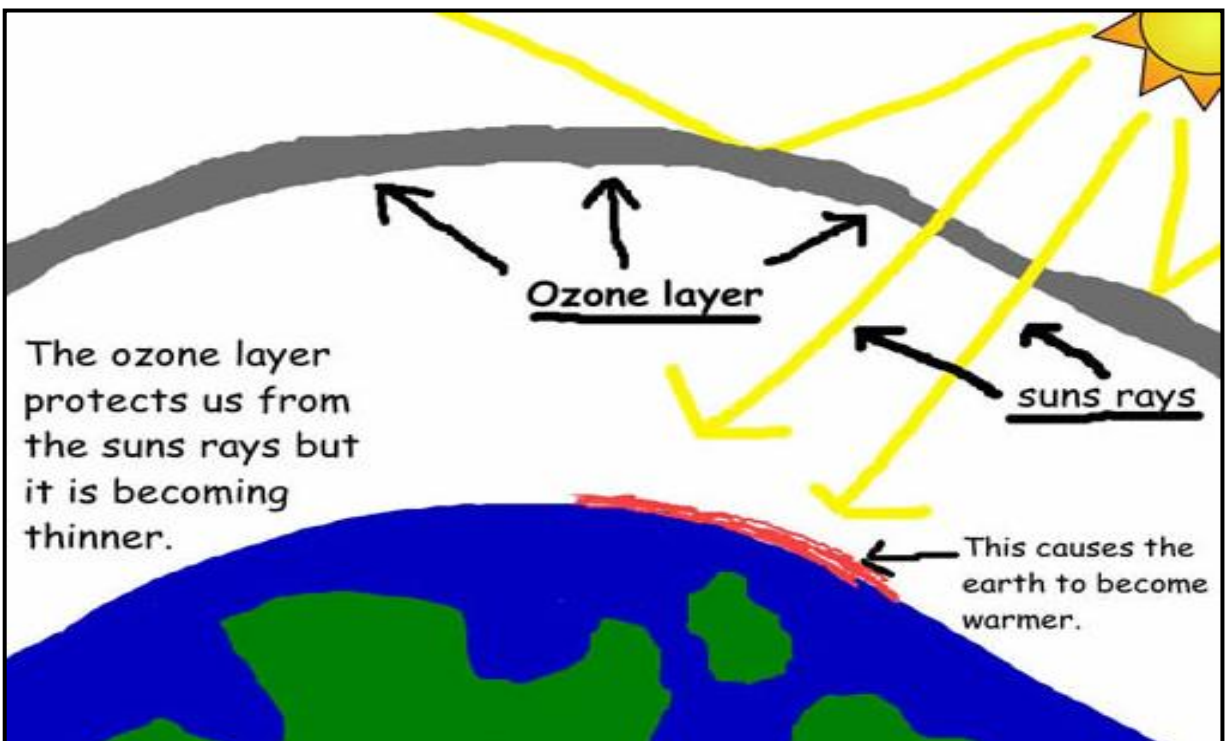
Ozone is a form of gas (oxygen) that gathers in the stratosphere to form a layer. Stratosphere is the second major layer of the earth's atmosphere which is above the troposphere.

Importance of the Ozone Layer

The ozone layer absorbs the sun's ultraviolet rays from reaching the earth. It protects all living things on earth by reducing the sun's harmful heat.

In the 1980's, scientist discovered that thin areas, or holes, were appearing in the ozone layer over the polar regions each spring. Most of the earth's ozone occurs in the stratosphere in very tiny quantities.

The Ozone Layer



Ozone Layer Depletion

Ozone Layer Depletion (reduce) refers to the destruction of the stratosphere. It creates holes in the ozone layer. The ozone layer does not encircle (surround) the earth at a uniform thickness. Places subject to intense sunlight, like the tropics, have high ozone levels, but thankfully in tiny amounts, as it is toxic to humans.

Ozone depletion or reduction of the upper atmosphere has been occurring for some time since 1978. Satellites have been measuring ozone levels, although data collection has not always been accurate due to the masking effect created by ground level ozone.

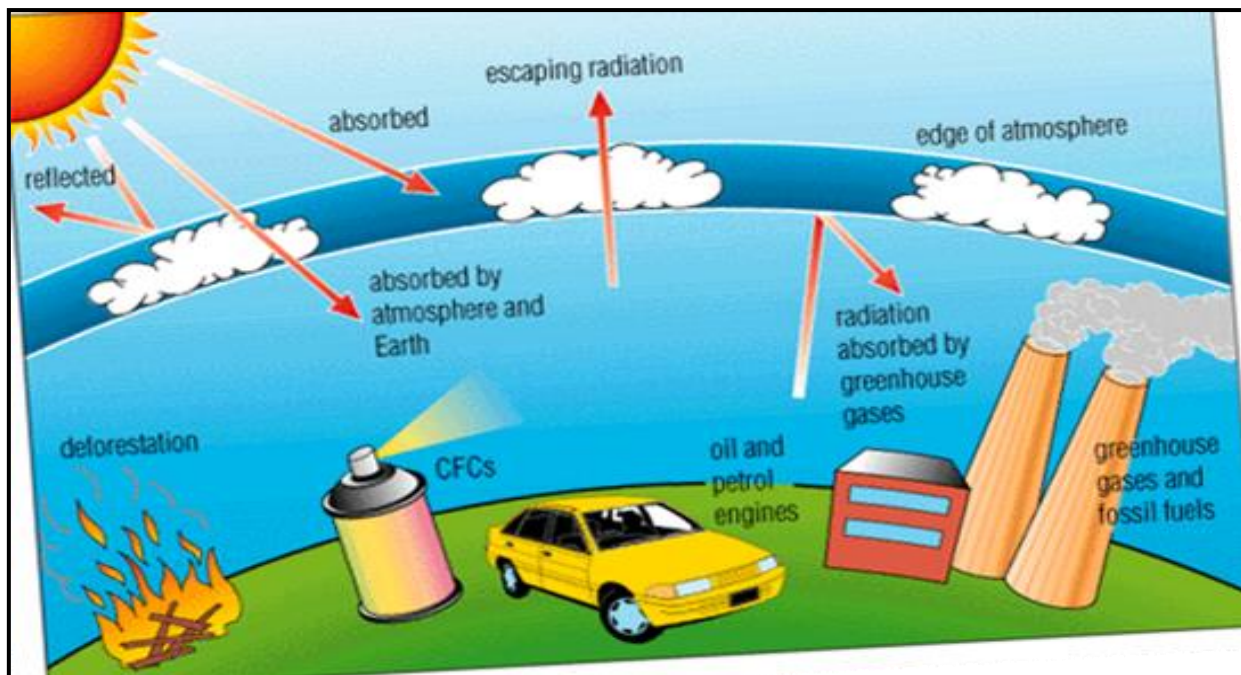
When layers of ozone above Hally Bay, Antarctica, were found to be reduced by 95 percent after the winter of 1987, scientists were concerned, as the ozone layer had never been broken before. Because the column of ozone above the area was much thinner than usual, it was referred to as a hole.

What causes ozone depletion?

The ozone (gas/oxygen) in the ozone layer is being broken down by;

- Chlorine (chemicals) from chlorofluorocarbon (CFCs) such as sprays, oil and petrol engines, etc.
- Deforestation (cutting down of trees)
- Burning fossil fuels

Destruction Of The Ozone



Ultraviolet radiation and the ozone

Ultraviolet rays come in three forms: A, B and C.

The shorter the wavelength, the greater is its ability to damage biological molecules.

- i) The longest wavelength is **UV – A**, which reaches the surface in large quantities and cause most sunburn.

- ii) **UV – B** has a shorter wavelength. It damages skin and may cause skin cancer. Type B also damages the eye retina and affects our immune systems. Normally UV – B is filtered by the ozone layer, but recent reductions in this gas have caused more harmful rays to reach the surface.
- iii) **UV – C** is the most harmful form of ultraviolet rays, but fortunately does not reach the surface in any great quantity, despite the thin ozone layer. Excessive (much more) doses of UV radiation also destroy marine organisms such as phytoplankton and zooplankton that live closer to the ocean surface.

Effects of Ozone Depletion

- Increases the risk of sunburn, skin damage and skin cancer in humans
- Damage to the eyes
- Damage crops and harm marine life
- The earth gets warmer which increases global warming

What can be done to reduce ozone depletion?

- At your home, try to unplug electronic devices which are not being used
- Fluorescent bulbs must be used rather than incandescent bulbs
- Plant as many trees as you can
- Educate your family and friends about ozone depletion so that everyone becomes aware and help in one way or another.



Summary

You have come to the end of lesson 28. In this lesson you have learnt that:

- ozone is a form of toxic oxygen that gathers in the stratosphere.
- ozone layer screens out harmful solar radiation.
- stratosphere is the layer above the troposphere.
- ozone depletion (reduction) is caused by chlorofluorocarbons (CFC's)
- effects of ozone depletion causes skin cancer, damages eye retina and immune system and destroy marine organism.
- column of ozone above areas, much thinner than usual, referred to as a hole.

NOW DO PRACTICE EXERCISE 28 ON THE NEXT PAGE



Practice Exercise 28

1. What is ozone and state why it is important?

2. How is the ozone layer destroyed?

3. What happens to the percent of UV – B on the ground for every one percent loss in the ozone layer?

4. List the effects of ozone depletion.

i)

ii)

iii)

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 5
--

Lesson 29: Global Warming



Welcome to lesson 29. In lesson 28, we learnt about ozone depletion. This brings us to the next topic on global warming, which is one of the factors for ozone depletion.



Your Aims:

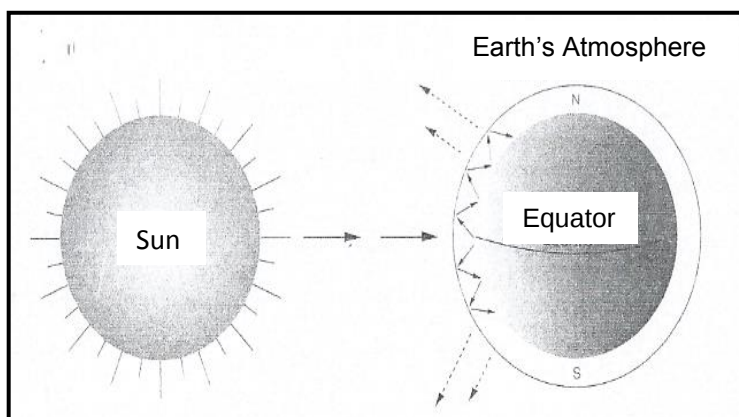
- define global warming and greenhouse effect
 - name the greenhouse gases and their sources
 - discuss the relationship between the greenhouse gases and global warming
 - identify measures or actions countries or governments have taken to deal with the issue
 - identify good practices that will help reduce greenhouse gas
-

What is Global Warming and greenhouse effect?

Greenhouse gas is a gas in the atmosphere that absorbs (take in heat) and emits (release) radiation.

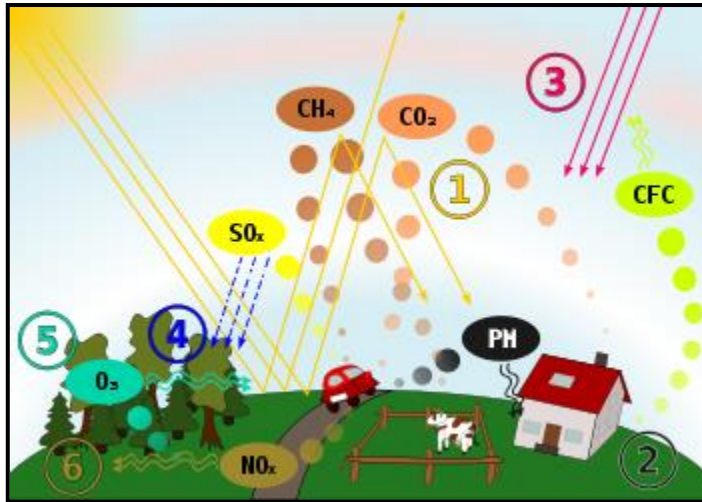
Radiation is powerful and very dangerous rays sent out from a source. Examples of greenhouse gases are; carbon dioxide, methane, water vapour, nitrous oxide and ozone.

Greenhouse effect refers to the bad or negative effects of large amounts of gases such as methane and carbon dioxide in the earth's atmosphere, trapping heat and causing the earth to become too warm.



Greenhouse gases trap some of the sun's rays. The more gas there is, the more rays are trapped. This increases temperature or results in global warming.

Causes and Effects of Air Pollution



- (1) Greenhouse effect
- (2) Particulate contamination
- (3) Increased UV radiation
- (4) Acid Rain
- (5) Increased ground level ozone concentration
- (6) Increased level of nitrogen oxides

Global Warming is an increase or rise in the average temperature of the earth's atmosphere and oceans. Global warming is caused by the actions of humans. Listed here are some ways people do which contribute to the warming up of planet earth.

- Deforestation (clearing of rainforests)
- Burning Fossil Fuels (coal, oil, gas)
- Releasing greenhouse gases (carbon dioxide, methane, water vapour, sprays etc.)

The bad or negative effect of global warming includes the following;

- making seawater more acidic, affecting marine life.
- it will heat ocean waters. The warmer waters will heat more air.
- rising sea levels as icecaps melt and oceans expand as they get warmer.
- changes to coastlines as sea levels rise
- changes to agriculture as temperature and rainfall patterns change (this could also be beneficial as rainfall may increase in some dry areas)
- an increase in stronger storms and cyclones, especially in the tropics
- harm to ecosystems as some plants and animals cannot live if their habit gets hotter.



Smoke from factories pollute the air

The solution is to reduce the amount of greenhouse gases people are putting into the atmosphere. Carbon dioxide makes up 70 percent of all greenhouse gases. Governments around the world will need to come together like they did to help preserve the ozone layer.

Many nations have already started to work together. An international meeting in Japan developed the Kyoto protocols. This is a set of guidelines to help prevent global warming.

What can you do to reduce greenhouse gases at home? You should:

- Bury cut grass, papers and any other things that can decompose.
 - Bury vegetable peelings, human and animal
 - Do not burn plastics
 - If you chop a tree down, plant a new one to replace it
 - Do not use spray paints to write graffiti
 - Minimise the use of body sprays
-



Summary

You have come to the end of lesson 29. In this lesson you have learnt that:

- global warming is the heating of the earth's atmosphere.
 - greenhouse – a glass house used to protect plants from the cold in temperature climates.
 - heating of earth by humans and nature
 - three major greenhouse gases – carbon dioxide, methane gas, water vapour.
 - Global warming effects
 - sea water becoming more acidic, affecting marine life.
 - raising sea levels
 - changes to agriculture as temperature and rainfall patterns change.
 - increase in stormy
 - harm to ecosystem
-

NOW DO PRACTICE EXERCISE 29 ON THE NEXT PAGE



Practice Exercise 29

1. Fill in the missing words

One of the biggest hazards that we face today is _____
_____.

This is the _____ of the _____ atmosphere. It is caused
by _____ and by _____.

Humans are speeding up this process by putting more _____
_____ into the atmosphere.

2. Name one of the major greenhouse gases?

3. Why are greenhouse gases needed?

4. When sea levels rise, island nations such as Tuvalu and Kiribati will be **submerged**.
What does this mean?

5. How can global warming be reduced? List two solutions:

i) _____

ii) _____

NOW CHECK YOUR ANSWERS AT THE END OF SUB-STRAND 5
--

SUB-STRAND 5

ANSWERS TO PRACTICE EXERCISES 27 – 29

Practice Exercise 27

1. Desertification/ ozone depletion/ acid rain.
 2. Forest fires are caused by lightning but human carelessness can cause fires.
 3. People in affected areas can be relocated or moved to higher grounds in the case of a tsunami.
 4. Destroy buildings, roads and bridges, kill people, etc.
-

Practice Exercise 28

1. Ozone is a form of (gas) oxygen that gathers in the troposphere to form a layer. It is important because it protects us from the harmful rays of the sun.
 2. It is destroyed by the release of very poisonous chemicals called the chlorofluorocarbons (CFC'S)
 3. There is an increase in percentage of UV-B on the ground for every one percent loss in the ozone layer.
 4. i) causes skin cancer ii) damages eye retina and immune system
 iii) destroys marine organisms.
-

Practice Exercise 29

1. global warming , heating , earth's , human , nature , greenhouse gases
 2. Carbon dioxide Methane gas *(any one of these)*
 3. Greenhouse gases are needed because they keep us warm.
 4. The island nations will go **under water (sink)**.
 5. i) reduce the amount of greenhouse gases people are releasing into the atmosphere.
 iii) governments around the world will need to work together to set guidelines to help prevent global warming.
-

Reference:

1. Baing, Susan and Tindall, Trevor 2010, *Social Science Outcomes Grade 9*, Pearson Australia, Victoria.
2. Johns, Eric 2004, *PNG history through stories*, Pearson Australia, Victoria.
3. Vicars ,Andrew and Ollett David, *A history of Papua New Guinea and its neighbours*, 1990, Department of Education, Papua New Guinea and John Wiley and Sons Australia Ltd, Australia.
4. Waiko, John Dademo,2003,*Papua New Guinea- A History of Our Time*, Oxford University Press, Victoria

FODE PROVINCIAL CENTRES CONTACTS

PC NO	FODE PROVINCIAL CENTRE	ADDRESS	CUG PHONES (COORDINATORS)	WIRELESS PHONES	SENIOR CLERK	CUG PHONE
1	DARU	P. O. Box 68, Daru	72228146	77522841	Mr Kevin Sere	72229047
2	KEREMA	P. O. Box 86, Kerema	72228124	77522842	Mr David Saria	72229049
3	CENTRAL	C/- FODE HQ	72228110	77522843	Mr Aubi Elodo	72229050
4	ALOTAU	P. O. Box 822, Alotau	72228130	77522844	Mr Albi Bapera	72229051
5	POPONDETTA	P. O. Box 71, Popondetta	72228138	77522845	Mr Stansen Sevese	72229052
6	MENDI	P. O. Box 237, Mendi	72228142	77522846	Mr Wari Tange	72229053
7	GOROKA	P. O. Box 990, Goroka	72228116	77522847	Ms Ovin Tuki	72229054
8	KUNDIAWA	P. O. Box 95, Kundiawa	72228144	77522848	Mr Denge Gundu	72229056
9	MT HAGEN	P. O. Box 418, Mt. Hagen	72228148	77522849	Mr Robert Maki	72229057
10	VANIMO	P. O. Box 38, Vanimo	72228140	77522850	Mrs Isabella Danti	72229060
11	WEWAK	P. O. Box 583, Wewak	72228122	77522851	Mr David Wombui	72229062
12	MADANG	P. O. Box 2071, Madang	72228126	77522852	Mrs Applonia Bogg	72229063
13	LAKE	P. O. Box 4969, Lae	72228132	77522853	Ms Cathrine Kila	72229064
14	KIMBE	P. O. Box 328, Kimbe	72228150	77522854	Mrs Bernadette Litom	72229065
15	RABAU	P. O. Box 83, Kokopo	72228118	77522855	Mrs Verlyn Vavai	72229067
16	KAVIENG	P. O. Box 284, Kavieng	72228136	77522856	Mr John Lasisi	72229069
17	BUKA	P. O. Box 154, Buka	72228108	77522857	Mr Marlyne Meiskamel	72229073
18	MANUS	P. O. Box 41, Lorengau	72228128	77522858	Ms Roslyn Keket	72229080
19	NCD	C/- FODE HQ	72228134	77522859	Mrs Marina Tomiyavau	72229081
20	WABAG	P. O. Box 259, Wabag	72228120	77522860	Mr Salas Kamberan	72229082
21	HELA	P. O. Box 63, Tari	72228141	77522861	Mr Ogai John	72229083
22	JIWAKA	c/- FODE Hagen	72228143	77522862	Joseph Walep	72229085

SUBJECTS AND GRADE TO STUDY

Grade Levels	Subjects
Grades 7 and 8	1. English Language
	2. Mathematics
	3. Science
	4. Social Science
	5. Making a Living
	6. Personal Development
Grades 9 and 10	1. English
	2. Mathematics
	3. Science – Biology/Chemistry/Physics
	4. Social Science
	5. Business Studies
	6. Personal Development
	7. Design and Technology- Computing
Grades 11 and 12	1. English - Applied English/Language and Literature
	2. Mathematics - Mathematics A/Mathematics B
	3. Science – Biology/Chemistry/Physics
	4. Social Science – History/Geography/Economics
	5. Business Studies
	6. Personal Development
	7. ICT

REMEMBER

- For **Grades 7 and 8**, you are required to do all six (6) courses.
- For **Grades 9 and 10**, you must study English, Mathematics, Science, Personal Development, Social Science and Commerce, Design and Technology-Computing is optional.
- For **Grades 11 and 12**, you are required to complete seven (7) out of thirteen (13) courses to be certified.
- For **Matriculation**, you must successfully complete 8 courses; 5 core and 3 optional courses.

Matriculation Certificate**CORE COURSES**

- Basic English
- English 1
- English 2
- Basic Maths
- Maths 1
- Maths 2
- History of Science & Technology

OPTIONAL COURSES

- Science Stream:
Biology, Chemistry and Physics
- Social Science Stream:
Geography, Introduction to Economics, and Asia and the Modern World

Your Provincial Coordinator or Supervisor will give you more information regarding each subject.

