



South Sudan

Secondary Geography 4

Secondary Geography for Secondary Schools has been written and developed by the Ministry of General Education and Instruction, The Government of South Sudan in conjunction with Subjects experts. This course book provides a fun and practical approach to the subject of Geography, and at the same time imparting life long skills to the students.

The book comprehensively covers the Secondary 4 syllabus as developed by Ministry of General Education and Instruction.

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- It provides opportunities for collaboration through group work activities.
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Secondary Geography 4



South Sudan

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South Sudan

SECONDARY

4

Geography

Student's Book 4



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Unit 1

GLOBALIZATION

Understanding Globalization

What is Globalization?

This is a method of interaction and integration among individuals, companies, and governments of different nations, this process is compelled by international trade, foreign investments and information technology.



Figure 1. An artistic impression of globalization.

Types of Globalization

They are three types of globalization, namely, **economic**, **cultural** and **political**.

Economic Globalization

It is the growing economic integration and interdependence of national, regional, and local economies across the world through strengthening of cross-border movement of goods, technologies, services, and capital. National economies influence one another. A country can be rich while another can be poor. Countries with better technologies sell them to other countries who lack such technologies.

The products of a developed country enter the marketplaces of countries that have demands for these products. Likewise, the natural resources of low income countries are sold to high income countries that require them. Therefore, globalization is mainly an economic process involving the transmission of economic resources from one country to another.

Cultural Globalization

This is the interaction of similar cultures around the world. Culture has increasingly become a commodity. Popular books and films have global markets. Harry Potter, among other similar books, has readers almost all over the world. English movies are seen almost in all countries. Western pop music has become popular in low income countries. The flow of culture is mainly from the North to the South. In the last few years the media owners of the West have shown interest in entering low income countries.

Cultural globalization has been facilitated by the information revolution, the spread of satellite communication, telecommunication networks, information technology and the Internet etc. This global flow of ideas, knowledge and values is likely to flatten out cultural differences between nations, regions and individuals.

As this flow of culture is mainly from the North to the South, and from the towns and cities to villages, it is the cultures of villages of poor countries which will be the first to suffer [cultural erosion](#).

Political Globalization

Political globalization refers to the formation of trans-national governing organizations. Countries around the world are trying to adopt similar political policies and styles of government in order to facilitate other types of globalization.

Since long, efforts have been on to bring the whole world under one government. The League of Nations as well as the United Nations have had efforts to bring the world under one government. It is believed that the world under one government will be safer and freer from conflicts.

The world has witnessed the rise of regional governments such as the European Union, COMESA, ECOWAS, AU and EAC. There are also multicultural governments that aim to facilitate other types of globalization.

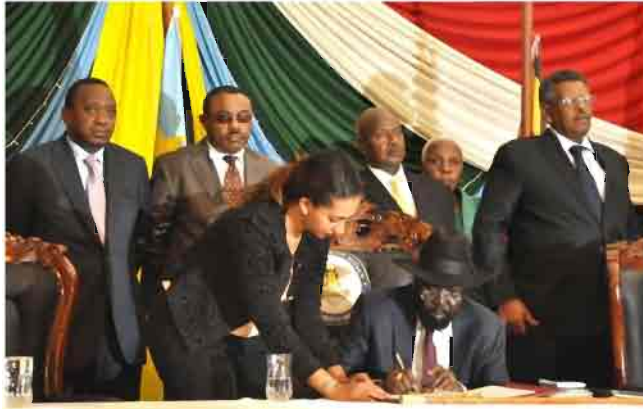


Figure 2. South Sudanese President, Salva Kiir signing the Agreement on the resolution of the conflict in South Sudan (ARCISS) at Freedom Hall, Juba, South Sudan. (2015)

Technological Globalization

The interaction between nations through technology such as television, radio, telephones, internet, etc. has made it easier for long distance communication as well as simplified the transmission of information. Technology was only available to the rich but is now far more available to the poor.



Figure 3. Video conferencing

Progress Check



In Groups:

Classify the following context into the different types of globalization:

1. Fatima, a law student at Cambridge University in the United Kingdom, communicating virtually with his brother back in Africa.



2. Mr. Noel, a large scale groundnut farmer in Lakes state seeking to export his produce to Uganda.
3. Tourists communicating with South Sudanese locals at Malakal, South Sudan.
4. Leaders of East African countries having an East African Community summit to device policies on imports and exports.

Factors influencing Globalization

The following are factors that have facilitated the growth of globalization.

Advancement in technology (communication)

Globalization is where it is today because of the advancements that the world has made in technology. Technology is one of the leading factors in the evolution of globalization. Information technology aids in the further development of globalization. The cost efficiency of many technologies is increasing, and these technologies are beginning to impact everyday life.

For example, the cell phone is becoming more available to the average consumers who rely on it. Cell phones are used for anything from family conversations to business calls, but for many they have become a way of life. Life might become impossible without the reliance on the cell phone. Another example of information technology is the Internet, which has significantly changed since its big introduction in the 1990's.



Figure 4. Smart phones

Transportation

Faster and cheaper transportation systems allow multinational corporations to construct manufacturing facilities across the globe while maintaining scheduled, frequent deliveries of parts and finished products. For example, advances in the aviation system allow businesses to make just-in-time deliveries from manufacturing plants to shops and other business enterprises.



Figure 5. Well-constructed highways quicken delivery of goods and services



Figure 6. Aviation has made long distance travelling simpler and faster.

Free Trade

Several barriers to trade are removed by regional groupings of nations like the EU (European Union). This makes International trade cheaper by reducing taxes levied on imports and exports. In Africa, regional trade blocs include COMESA (Common Market for Eastern and Southern Africa), EAC (the East African Community) among others.

International consumption of goods

Consumer tastes on goods and other materials has changed, and consumers are more willing to try foreign products: The arrival of world television, as an example, has exposed shoppers to world advertisements on what's out there in alternative countries.



Figure 7. An example of a global commercial advertisement

Emerging markets in low income countries

High income countries have a high population growth, enticing the high income countries to market their products. Most European manufacturers have started their markets and industrial outlets in parts of Africa and Asia.

Removal of Capital Exchange Controls

The movement of cash from one country to a different was additionally controlled, and these controls were raised over the identical amount. This allowed businesses to move cash from one country to a different in an exceedingly seek for higher business returns; if investment in one's own country looked unattractive, a business may purchase businesses in another country.

Progress check



1. Why do you think people come to South Sudan?
2. Why would you want to visit other countries around the world?

Impacts of Globalization

Globalization has both positive and negative impacts. Here are some of the impacts of globalization:

Positive Impacts of Globalization

Economic growth on low income countries

Globalization helps low income countries to transact with rest of the world to increase their economic growth, thus solving the poverty problems in their country. In the past, low income countries were not able to tap on the world economy because of trade barriers. They could not share the same economic growth that high income countries had. However, with globalization, the World Bank and International Monetary Fund (IMF) encourage low income to go through market reforms and radical changes through large loans. Many low income countries began to take steps to open their markets by removing tariffs and free up their economies. The high income countries were able to invest in the low income countries, creating job opportunities for the poor people.



Figure 8 The World Bank headquarters in Washington DC, United States of America.

Advancements in Education and Health systems.

Globalization contributed to the development of health and education systems in the low income countries. We can clearly see that education has increased in recent years, because globalization promotes jobs positions that require higher skills set. This demand allowed people to gain higher education. Health and education are basic tools to improve any country. There are strong relationships between economic growth and health and education systems. Through growth in economy, living standards and life expectancy for the low income countries gradually improve. With more riches, poor nations are able to supply good health care services and sanitation to their citizens. In addition, the government of low income countries can provide more capital for health and education to the poor, which leads to a decrease in the rates of illiteracy.



Figure 9. Nairobi hospital, Kenya is among the biggest hospitals in East Africa. (Built in April 1954)

Increased competition.

Globalization has caused nations to be productive in terms of economic produces such as agricultural exports, manufactured and processed goods among others. This has led to competition since global consumers of these products have a wide variety of selections to choose from. With more contestants to fight over market share, each company has to continuously look to improve their goods or services or create more value for their consumers. This means better products and occasionally lower prices, which is a good thing for buyers.

Creation of Employment

High income countries have tapped into the resources of low income countries leading to industrialization. This has led to creation of new job opportunities for people living in the low income countries. This can also have a negative impact on the low income countries since job opportunities now move from low income countries to the low income countries hence reduced job opportunities.

Business Investments

As a result of globalization, low income countries which perform well in the field of business and economics invite foreign investors. Foreign companies have directly invested in low income countries by opening local production units and international branches. Factors that attract financial investors include: availability of natural resources and energy, which include minerals, timber, agricultural produce, availability of wildlife and variety of landforms in the field of tourism, availability of skilled labour and existence of peace.

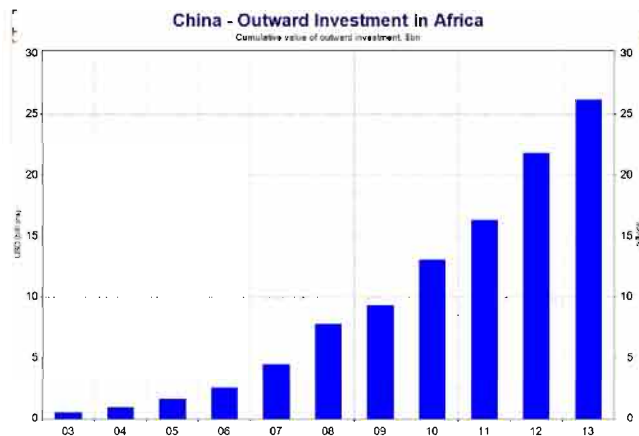


Figure 10. A graph showing China's investment in Africa

Progress Check



1. In groups discuss how education and health systems have changed over the last 50 years. What factors do you believe have been the most significant in influencing these changes?
2. Design a poster advertising any job opportunity within South Sudan to the world.

Negative impacts of Globalization

Erosion and assimilation of culture

Many low income countries are concerned about the growth of globalization because it might lead to the destruction of their own culture, traditional identity, customs and their language. Low income countries' customs and traditions have changed. They wear and behave like western nations, a few people are wearing their traditional clothes. Moreover, globalization leads to the disappearance of many words and expressions from local languages since many people use English and French words.

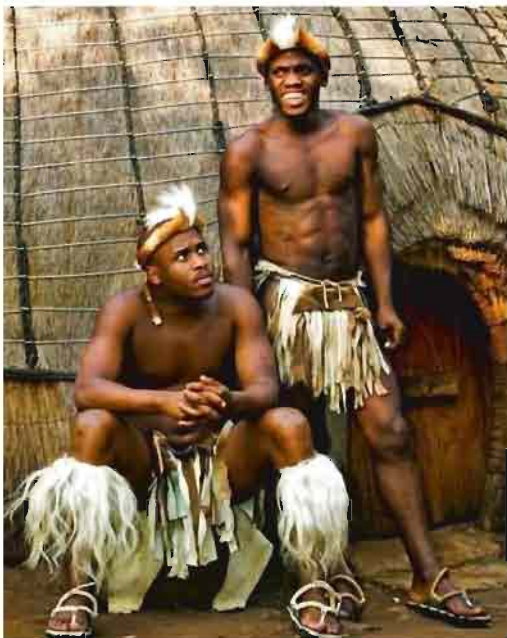


Figure 11. Traditional African dressing and modern dressing.

Globalization increases world's carbon dioxide emission

Enhancements in transportation and the rapid growth of industries as a result of globalization has increased the amount of carbon dioxide being released in the atmosphere as a result of human activity. This leads to acceleration in global warming which in turn is causing **rapid climate change**.

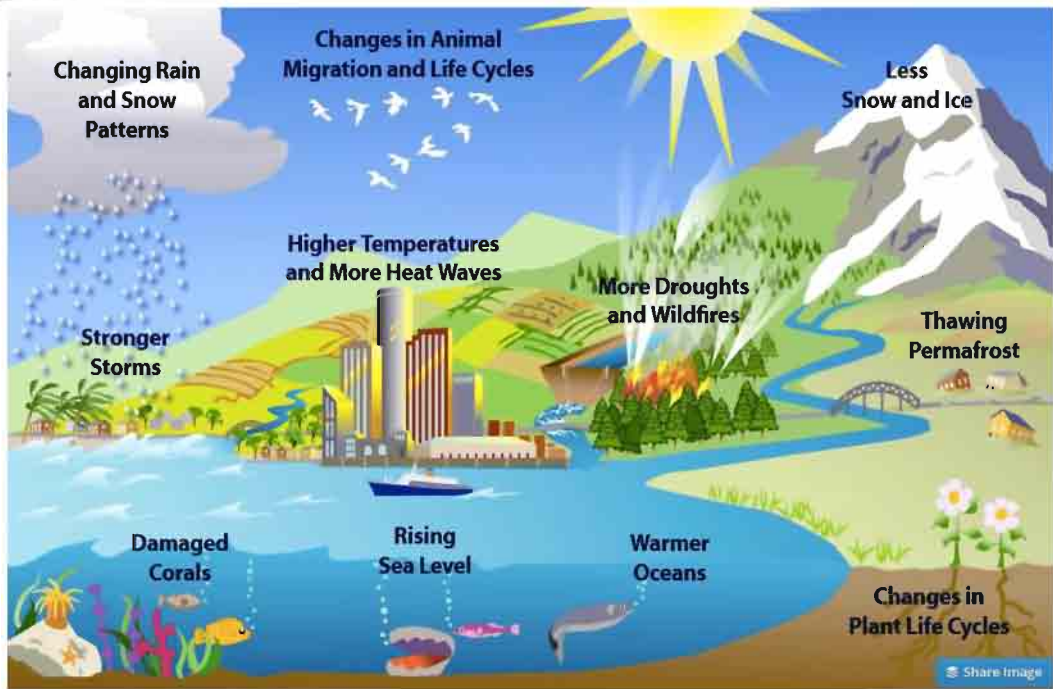


Figure 12. Effects of global warming

Domination of High Income Countries in world trade

High income countries have dominated world trade because of financial investments, loans and grants offered to low income countries. Globalization mainly operates in the interest of the rich countries which continue to dominate the world trade market at the expense of low income countries.

Increased gap between the rich and the poor

Globalization should have resulted in creation of wealth and prosperity, but greed and corrupt leaders have ensured that wealth is not distributed equally, leading to a widening gap between the rich and the poor.

Rise in health risks

Globalization has brought individuals from various countries together, and this has led to numerous health risks such as the spread of, Human Papilloma Virus (HPV), Ebola, HIV/ AIDS, swine flu among others.

Rise in terrorism and criminal activities

Terrorism and other criminal activities are on the rise as a result of globalization. This is through technological developments in information and weaponry. Terror attacks have been on the rise in different nations around the world. A good example is the West gate shopping mall attack by the al-Shabaab terror group in Nairobi, Kenya and the September 9/11 attack on the world trade center in New York City, U.S.A in 2001



Figure 13. The Terror attack the world trade center, New York City, U.S.A in the year 2001

Progress Check



1. What do you believe could mitigate the negative effects of Globalization?
2. How do war, terrorism and criminal activities affect the economy of a country?



Comprehensive Activity 1

Organize yourselves in groups and answer the following questions:

1. What do you understand by the term Globalization?
2. What are some of the factors that influence Globalization?
3. How has globalization affected the lives of the people of South Sudan?



Case study 1

Cultural Erosion



As people from different regions around the world interact, they share their cultures, ideas, language among others. Unfortunately this interaction has led to the erosion of local cultures since Africans now want to copy from the western culture.

As a class debate on the validity of this statement

Global Groupings

What are Global Groups?

The groups that countries are classified in can be based on their wealth, the provision of basic needs or political attentions.

Ways of classifying nations into Global Groupings

There are two major classifications of global groupings and they include:

Economic Groupings

Economic development is used to categorize countries into economic groups. Measures of development, such as **per capita gross domestic product (GDP)** and the **human development index (HDI)**, are used to rank countries in economic groups. Countries can be broadly divided into two major economic categories namely: **High income** and **low income**. These categories were previously referred to as **developed** and **developing** countries but are increasingly described as **advanced** and **emerging market economies**.

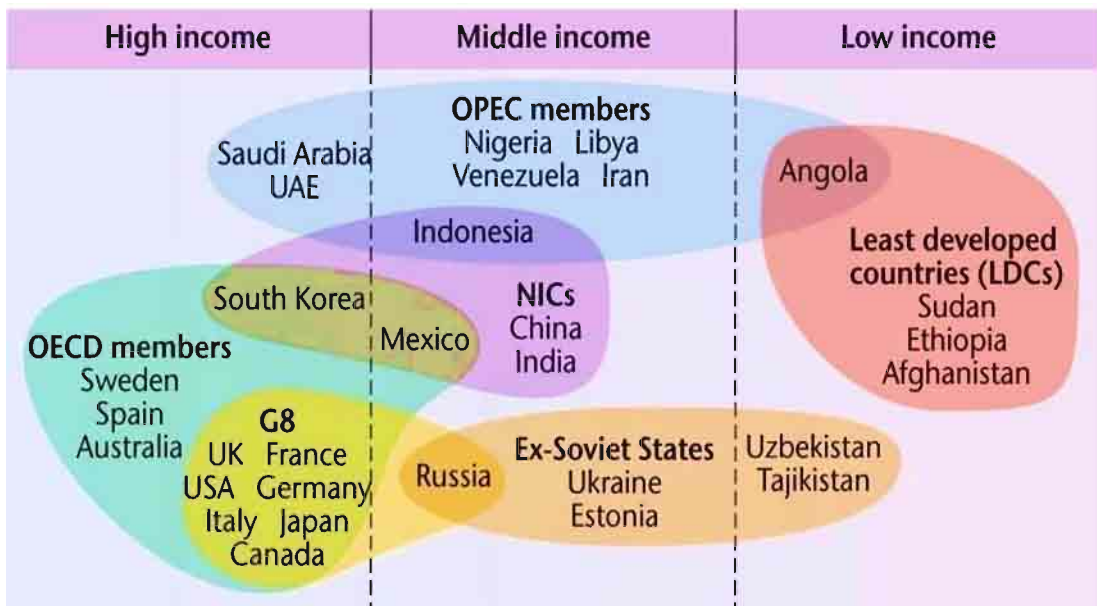


Figure 14. World economic grouping

Major economic groups in the world include:

- a) **The G8:** or the Group of eight G8 are countries with the world's highly industrialized economies. members include **France, USA, Germany, Italy, Japan, Canada** and the **United Kingdom**,
- b) **NICs: Newly Industrialized Countries:** are countries whose economies have not yet reached developed country status. They have just been industrialized and undergo rapid economic growth. They include **China, Mexico, India, South Korea,** and **Indonesia**.
- c) **OPEC: The Organization of Petroleum Exporting Countries** is an organization of oil producing countries that control the world's oil exports and holds a higher percent of the world's oil reserves. Their decisions have a huge impact on future oil prices. Member states include **Saudi Arabia, Venezuela, Libya, Iran, United Arab Emirates,** and **Iran** among others.
- d) **OECD: The Organization for Economic Co-operation and Development (OECD)** is an intergovernmental economic organization with 35 countries. Their major aim is to stimulate economic progress and world trade. Most OECD members are high-income economies with a very high Human Development Index (HDI). Members include **Canada, Sweden and Australia** among others.
- e) **LICs: The Low Income Countries (LICs)** are a group of countries that have been classified by the United Nations as "low income" in terms of their low gross national income (GNI), their weak human resources and economic weakness. They include most of African states.

Progress check



1. Classify the following countries into the major economic groups in the world:
 - a) Kenya, Uganda, Tanzania, Rwanda and Burundi.
 - b) United States of America, France, England, Japan.
2. Can you identify South Sudan to the major economic groups? Justify your answer with valid reasons.

Political Groupings

In this type of grouping, countries, usually at similar development levels as well as in the same geographical region, agree to form trade blocs by signing international treaties which permit tariff- and quota-free trade. A **tariff** is a tax or duty to be paid on a particular class of imports or exports while a **quota** is a limited amount of a particular product which under authorized controls, can be produced, exported, or imported. The World Trade Organization works to increase free trade between such trade blocs.

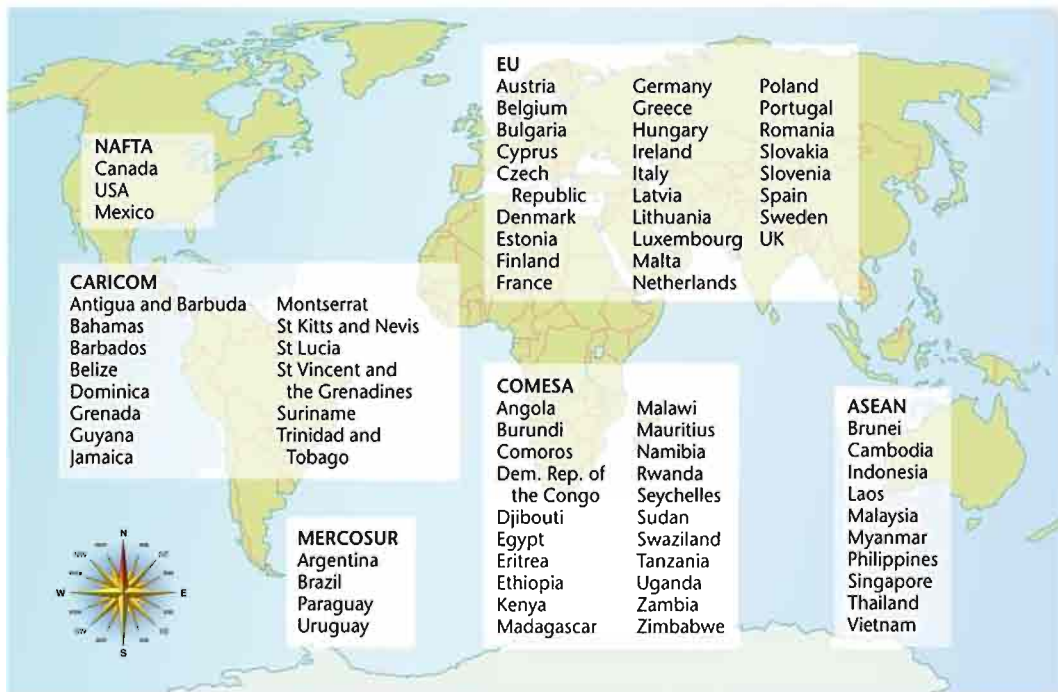


Figure 15. Selected regional political trade bloc groupings

The Commonwealth

It is an organization involving 76 countries which were former British colonies. The Members have no legal responsibility to one another. Instead, they are united by language, history, culture and their shared values of democracy, freedom of speech, human rights, and the rule of law. These values are protected in the Commonwealth Charter and promoted by the Commonwealth Games.



Figure 16. The commonwealth flag



Figure 17. Commonwealth member states



Figure 18. Female athletes participating in a commonwealth competition

The European Union (E.U)

The European Union is a united trade and economic organization of 28 countries. Its aim is to be more competitive in the global economy and balance the needs of its independent economic and political members.

The EU's members include: Belgium, Austria, Greece, Hungary, Bulgaria, Croatia, Cyprus, Czech Republic; Lithuania, Denmark, Malta, Estonia, Finland, France, Germany, Romania, Slovakia, Netherlands, Spain, Sweden, Latvia, Luxembourg, Ireland, Italy, Poland, Portugal, Slovenia, and the United Kingdom.

Note: The United Kingdom is planning to exit the European Union on 29th March 2019.

The euro is the European Union's main currency. It is the second most frequently used currency in the world after the U.S. dollar. The EU eliminates all border restrictions between members allowing the free flow of goods and people. Any product manufactured in one country can be sold to another without tariffs or duties. Workers can operate in all member countries thus reducing the cost of airfares, the internet, and phone calls.



Figure 19. The flag of the European Union.



Figure 20. A map showing European Union member states however, The United Kingdom is planning to exit EU)

African Union (The A.U)

This is an organization of all 55 countries on the African continent, established on 26 May 2001. Its major aim was to replace the **Organization of African Unity (OAU)**. The AU's headquarter is based in **Addis Ababa**.

Other aims of African Union include:

- Achieving unity between all African countries.
- To defend the sovereignty, integrity and independence of its members.
- To speed up the political and social-economic integration of its members.

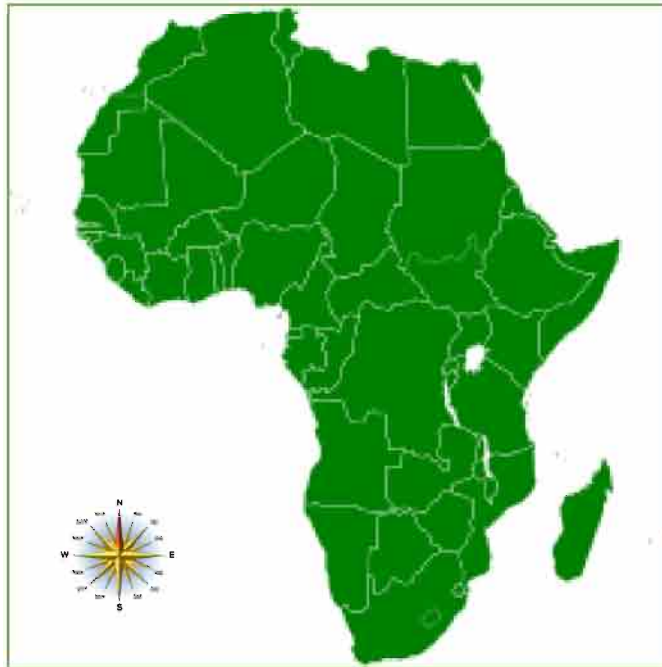


Figure 18. African Union Member states.

COMESA (Common Market for Eastern and Southern Africa)

This is the largest regional economic organization in Africa, with **19 countries** and an approximated population of **390 million**.

The main objectives of COMESA are:

1. To strengthen relations among member countries and the rest of the world.
2. Promotion of research and adaptation of science and technology for development.
3. To nurture closer relations amongst member states.
4. Promote growth and development of the members.
5. Co-operate in promotion of peace, security and steadiness among member states.
6. Promote the creation of an environment that allows foreign cross-border and local investment.
7. To raise the standards of living of its people by promoting development in economic activities.

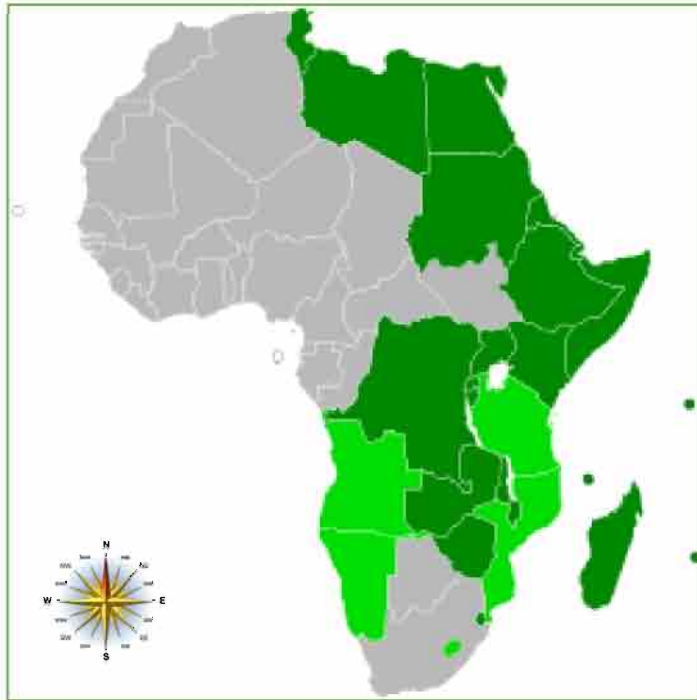


Figure 19. COMESA member states

The East African Community (E.A.C)

This is an international organization consisting of six countries such as: Burundi, Kenya, Rwanda, South Sudan, Tanzania, and Uganda. South Sudan joined the East African Community in 2016.



Figure 21. The East African Community



Case study 2

Economic impacts of Globalization

Organize yourselves in groups and perform a research on the following questions. Present your findings before the class.

- ✎ How can natural resources, energy, skills and culture become magnets for investments and influence global connectivity?
- ✎ How do political groupings benefit South Sudan?



Exercise 1

In pairs, answer the following question:

1. What are the main **negative** and **positive** effects of Globalization?
2. In reference to the image below, design, share and explain your own perception of globalization.



Unit 2

SEAS AND OCEANS

Understanding Seas and Oceans

What are Seas and Oceans?

Oceans can be defined as saline waterbodies that comprises a large part of the earth's hydrosphere. There are four main oceans found on earth they include: the Pacific, Atlantic, Indian, Southern (Antarctic), and Arctic Oceans.



Figure 22. Distribution of seas and oceans in the world

A **sea** is a large water body that is smaller as compared to an ocean. They are usually situated near land and are used to connect the land with an ocean. They are also associated with heavy waves that are not visible in the oceans. Well known seas include the Mediterranean, Baltic, Bering, Black, Caribbean, Coral, North, Red, and Yellow. The largest seas in the world are the South China Sea, the Caribbean Sea, and the Mediterranean Sea.

Coasts and coastal landforms

What are coasts?

Coasts are areas where dry land meets oceans and seas. They are among the most beautiful landscapes on the planet. The coastal landscape It reflects the differing processes of

1. **Erosion:** the gradual wearing away of earth surfaces through the action of wind and water.
2. **Deposition:** the accumulation and building up of natural materials).

The coast and coastline begin where the shore ends at its high tide mark. The line between the coast and the shore at high tide is the coastline. The coast extends landward from the coastline to the first major change in terrain features, which may be miles inland. This could be a highland or a forest or some other type of terrain.

Factors leading to the formation of coastal landforms

The landforms that develop and persist along the coast are the result of a combination of processes acting upon the deposits and rocks present in the coastal zone. The most prominent of these processes involves waves and the currents that they generate, along with tides. Other factors that significantly affect coastal morphology are climate and gravity.

Waves

The most noticeable of all coastal processes is the frequent motion of the waves moving toward the beach. Waves vary greatly in size over time at any given location and also vary from place to place. Waves interact with the bottom of the ocean as they travel into shallow water; as a result, they cause sediment to become temporarily suspended and available for movement by coastal currents.

The larger the wave, the deeper the water in which this process takes place and the larger the particle that can be moved. Even small waves that are only a few tens of centimeters high can pick up sand as they reach the shore. Larger waves can move cobbles and rock material as large as boulders. Generally, small waves cause sediment (usually sand) to be

transported toward the coast and to become deposited on the beach. Larger waves, typically during storms, are responsible for the removal of sediment from the coast and its transportation out into relatively deep water.

Waves erode the bedrock along the coast largely by abrasion. The suspended sediment particles in waves, especially pebbles and larger rock debris, have much the same effect on a surface as sandpaper does. Waves have considerable force and so may break up bedrock simply by impact.

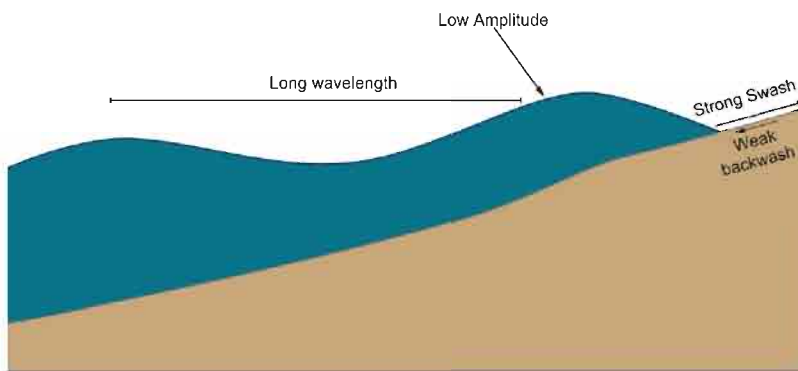


Figure 23. Constructive waves

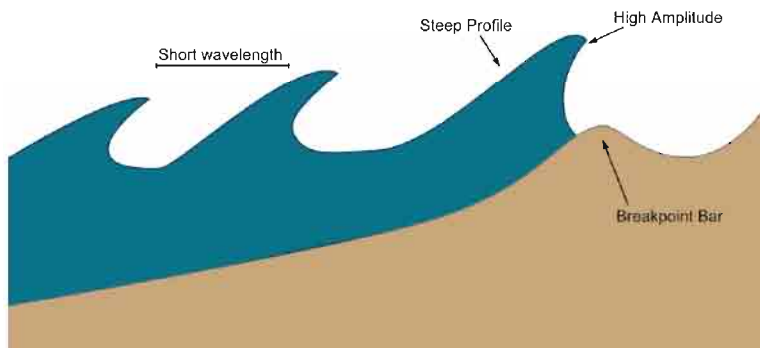


Figure 24. Destructive waves

Progress Check



1. With the help of your teacher, create a model to mimic the action of the two types of waves as shown above. Use the resources provided by your teacher.
2. Discuss how the action of the waves affect people around the coast.

Longshore currents

Waves usually approach the coast at some acute angle rather than exactly parallel to it. Because of this, the waves are bent (or refracted) as they enter shallow water, which in turn generates a current along the shore and parallel to it. Such a current is called a **longshore current**, and it extends from the shoreline out through the zone of breaking waves. The speed of the current is related to the size of the waves and to their angle of approach. Under calm conditions, longshore currents move only about 10–30 centimeters per second; however, under stormy conditions they may exceed one meter per second. The combination of waves and longshore current acts to transport large quantities of sediment along the shallow zone neighboring the shoreline.

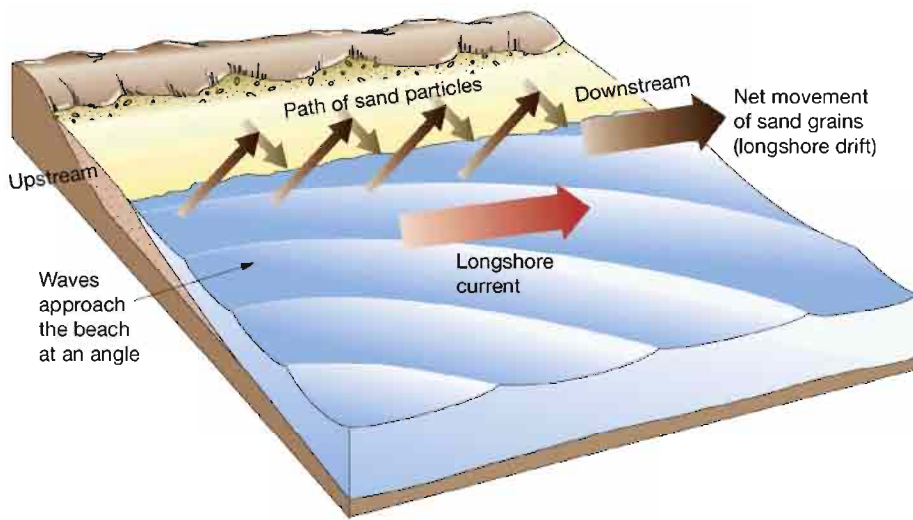


Figure 25. Longshore currents

Because longshore currents are caused by the approaching and refracting waves, they may move in either direction along the coast, depending on the direction of wave approach. This direction of approach is a result of the wind direction, which is an important factor in determining the direction of longshore currents and the transportation of residues along the shoreline.

Although a longshore current can entrain sediment if it moves fast enough, waves typically cause sediment to be picked up from the bottom, and the longshore current

transports it along the coast. In some locations there is quite a large volume of net sediment transport along the coast because of a dominance of one wind direction (and therefore wave direction) over another. This volume may be on the order of 100,000 cubic metres per year. Other locations may experience more of a balance in wave approach, which causes the longshore current and sediment transport in one direction to be nearly balanced by the same process in the other direction.

Rip Currents

Another type of coastal current caused by wave activity is the **rip current** also known as rip tides. As waves move toward the beach, there is some transport of water towards the shoreline. This leads to an upward slope of the water level, so that the absolute water level at the shoreline is a few centimeters higher than it is beyond the surf zone. This situation is an unstable one, and water moves seaward through the surf zone in an effort to relieve the instability of the sloping water. The seaward movement is typically confined to narrow pathways. In most cases, rip currents are regularly spaced and flow at speeds of up to several tens of centimeters per second. They can carry sediment and often are recognized by the plume of suspended sediment moving out through the surf zone. In some localities rip currents persist for months at the same site, whereas in others they are quite short-lived.

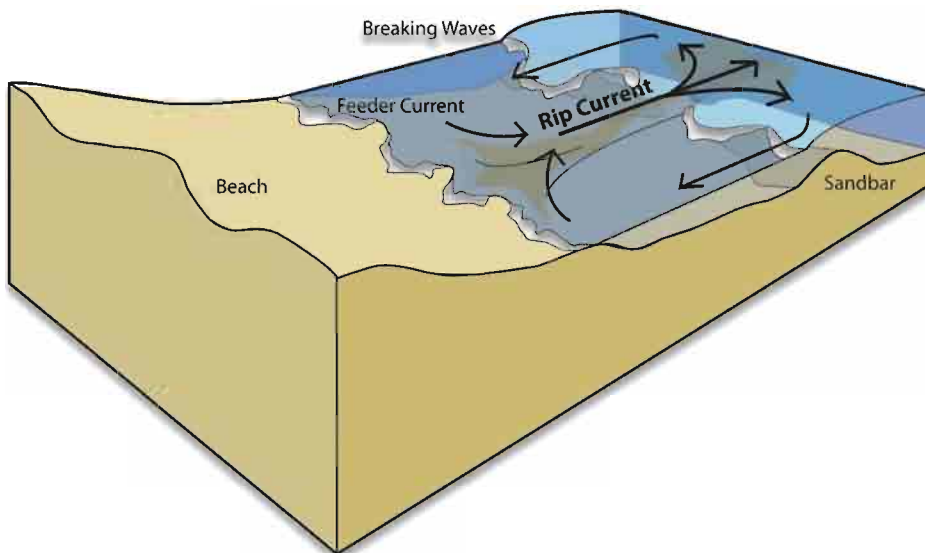


Figure 26. Rip Currents

Tides

A **Tide** is the periodic rising and falling of water in oceans and other large bodies of water in response to the gravitational attraction of the Moon and the Sun upon Earth. Although the Sun is larger than the Moon, the Moon is closer to Earth and, therefore, its gravitational force is greater. The gravitational pull of the Moon creates two types of tides: **high** and **low**.

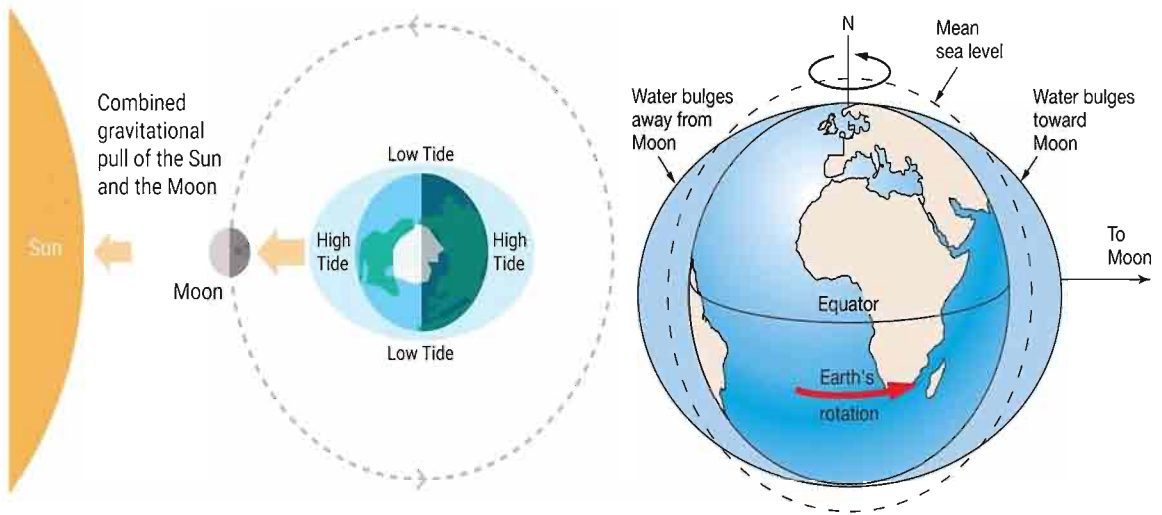


Figure 27. Tidal bulge due to moon's gravitational pull.

A **tidal bulge** occurs in the oceans on the side of Earth nearest the Moon; at the same time, a second tidal bulge occurs on the opposite side of the Earth. This second bulge forms because the force of the Moon's gravity pulls the solid body of Earth slightly away from the water on earth's far side. These bulges are high tides. The areas between the tidal bulges experience low tide.

Research Quiz



Research how sea and ocean tides affect different places around the world in different ways

Types of Coastal landforms

The coastal environment of the world is made up of a wide variety of landforms with different sizes and shapes ranging from gently sloping beaches to high cliffs. Coastal landforms are divided into two broad categories: **erosional** and **depositional**.

Erosional coastal landforms

Erosional coastal landforms are features formed due to processes of erosion that occur on the shoreline. The four main stages of erosion that lead to the formation of coastal landforms include:

1. **Abrasion:** this occurs when waves transport material which hit the cliff and gradually wear it away.
2. **Hydraulic action:** occurs as waves approach the coast they trap air and force it into gaps in the cliff. Eventually this weakens the rock.
3. **Attrition:** Occur when waves cause the rocks to crash against each other, breaking them down into smaller and rounder pieces.
4. **Corrosion** (also known as **solution**) - salts and acids in seawater dissolve the rock gradually over thousands of years.

The following are coastal landforms formed due to coastal erosion:

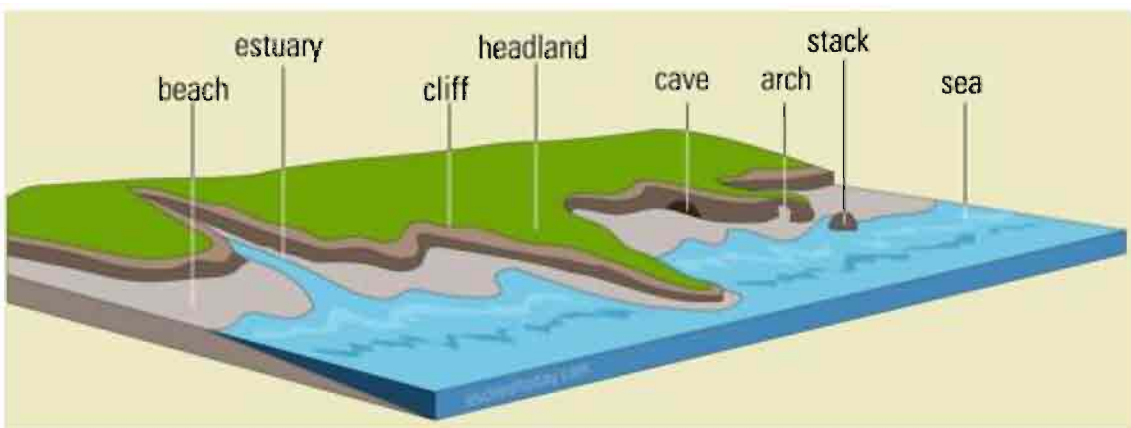


Figure 28. Erosional coastal landforms

Cliffs, Notches and wave-cut platforms

Cliffs are shaped through a combination of erosion and weathering - the breakdown of rocks caused by weather conditions. Soft rock, eg sand and clay, **erodes easily** to create gently sloping cliffs. Hard rock, eg chalk, is more resistant and **erodes slowly** to create steep cliffs. The following events of erosion takes place at cliffs:

1. Weather weakens the top of the cliff.
2. The sea attacks the base of the cliff forming a **wave-cut notch** which is the point of maximum impact of destructive waves at the base of a cliff which results in undercutting of the cliff face and subsequent rock fall.
3. The notch increases in size causing the cliff to collapse.
4. The backwash carries the rubble towards the sea forming a **wave-cut platform** which is a wide, rock base of eroded cliffs that extends as cliffs erode inwards.
5. The process repeats and the cliff continues to erode inwards.

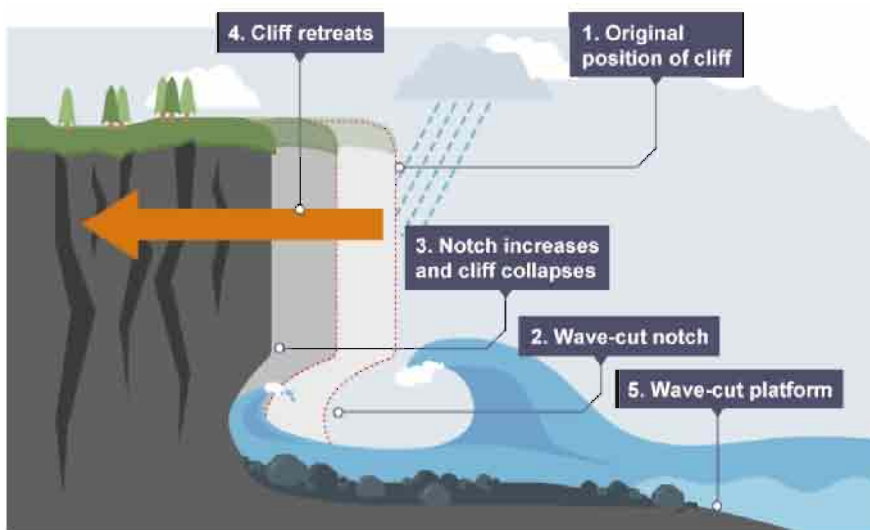


Figure 29. Cliff Erosion

Progress Check



1. Describe the effects of cliff erosion to the people living around the coast.
2. How can coastal communities prevent or prepare for this type of erosion?

Headlands and Bays

Bays are water bodies which are bordered by land on three sides, and the water regions are referred to as gulfs. **Headlands** are land bordered by either salt or fresh water on three sides; these lands are referred to as **capes**. Bays are made up of soft rocks while headlands are made up of hard rocks. Bays and headlands are formed where the parallel bands of harder and softer rocks are perpendicular to the coastline. Headlands are usually formed when the ocean attacks a part of the coastline with alternating bands of soft and hard rocks. Soft rock bands like **clay** and **sand** tend to erode faster than resistant rocks like chalk.

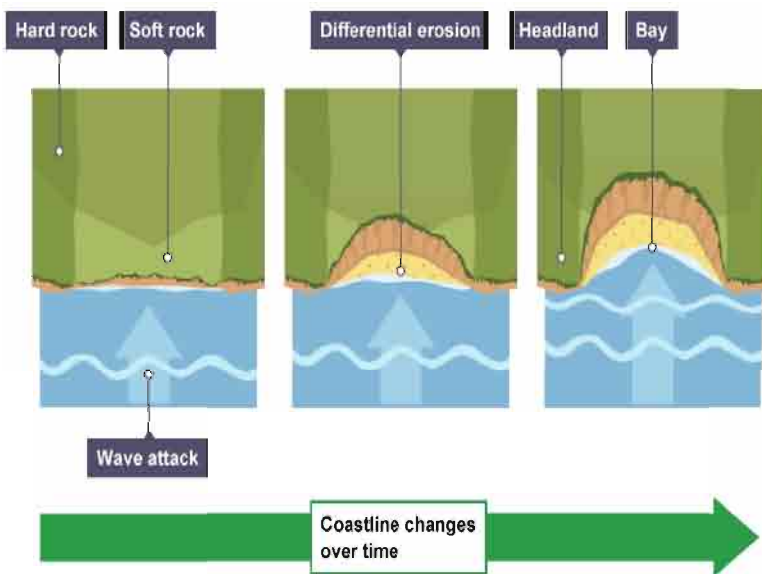


Figure 30. Left: Formation of headlands and bays pictured right.

This will leave part of the land protruding out into the ocean, and this land is referred to as a headland, and the region where the band of soft rocks has been eroded away from right next to the protruding headland is referred to as a bay. The process of erosion which occurs during this formation includes hydraulic action, attrition, and various types of weathering. Continuous attacking of the materials and waves from the ocean on the cliff will cause soft rock erosion, thus leaving some parts of the land protruding. The bay forms in places where less resistant rocks or soft rocks like clay and sands have eroded

leaving a band of more resistant rocks like granite, limestone, and chalk where headlands form. Wave refraction, which occurs on the headland, concentrates wave energy on the land, and this leads to the creation of stacks, natural arches, and caves.

Progress Check



In pairs, research and explore some headlands and bays in contrasting localities around the world. Use any reference material.

Caves, arches, stacks and stumps

Caves occur when waves force their way into cracks in the cliff face. The water contains sand and other materials that grind away at the rock until the cracks become a cave. Hydraulic action is the predominant process. If the cave is formed in a headland, it may eventually break through to the other side forming an **arch**.

The arch will gradually become bigger until it can no longer support the top of the arch. When the arch **collapses**, it leaves the headland on one side and a **stack** (a tall column of rock) on the other. The stack will be attacked at the base in the same way that a wave-cut notch is formed. This weakens the structure and it will eventually **collapse** to form a **stump**.

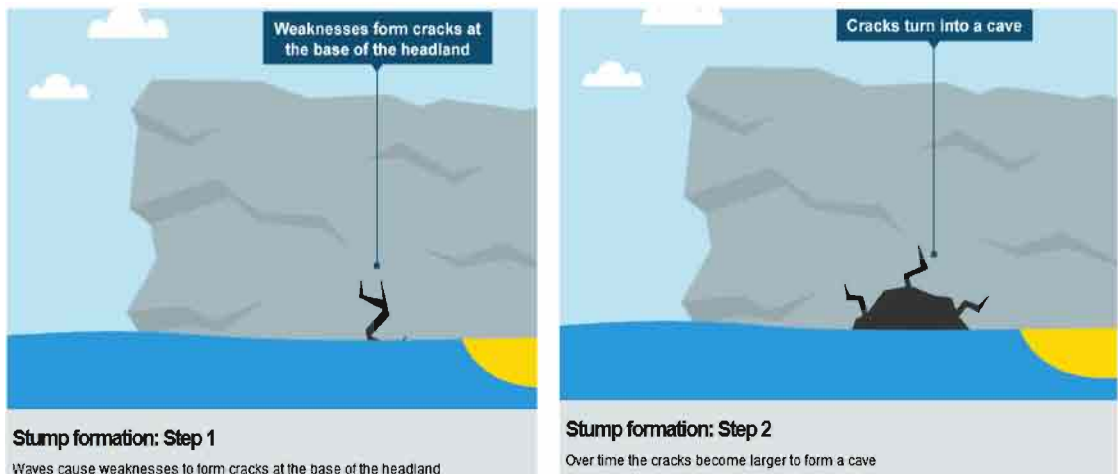
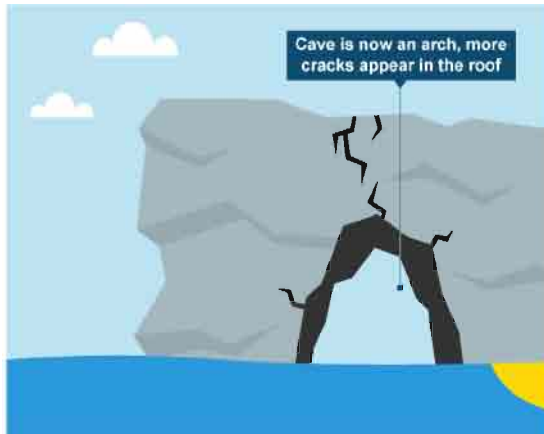
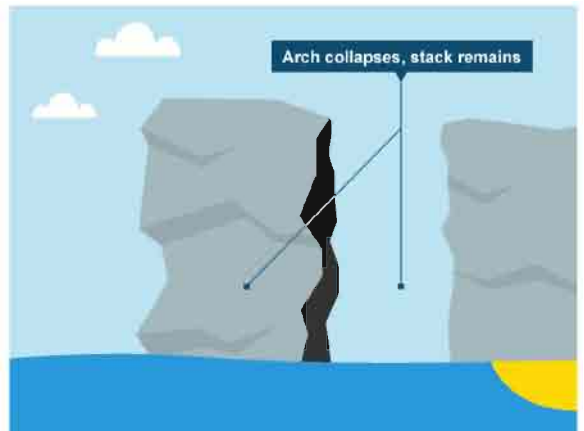


Figure 31. Formation of a cave



Stump formation: Step 3

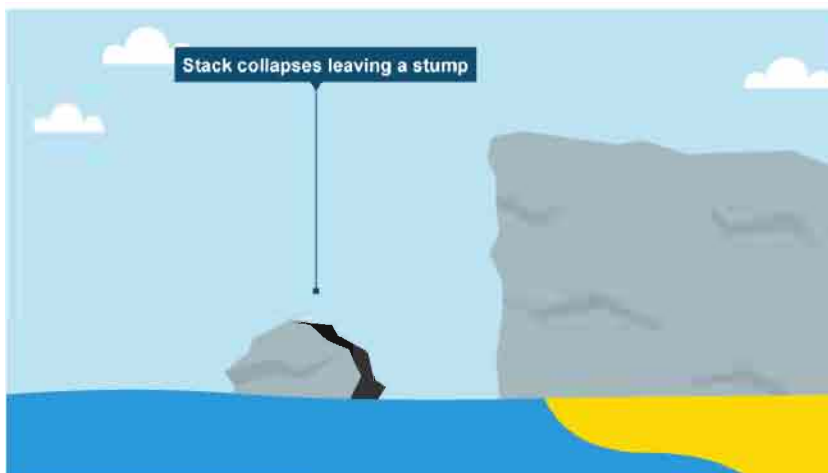
The cave gets bigger and cracks appear above the cave to the top of the headland



Stump formation: Step 4

The arch grows larger and eventually collapses leaving a stack separated from the mainland

Figure 32. Formation of an arch and a stack



Stump formation: Step 5

The stack erodes and becomes a stump

Figure 33 Formation of a stump



Progress Check

In pairs, look at the following images. List down the visible erosional coastal landforms.



Depositional Coastal Landforms

If rocks and cliffs are being continually weathered, eroded and moved then it stands to reason that this will generate a lot of material that will need to be deposited somewhere else along the coastline. The major deposition landforms are **beaches**, **spits** and **bars**. Deposition occurs when wave velocities slow, or when ocean currents slow due to encountering frictional forces such as the sea bed, other counter currents and vegetation.

Beaches

Beaches are a common feature of a coastline. Beaches are made up of eroded material that has been transported from elsewhere and deposited by the sea. **Constructive** waves help to build up beaches. The material found on a beach depends on the topography of the area and wave energy. A cross-section of a beach is called a **beach profile**. The material found on a beach varies in size and type as you move further away from the shoreline. The smallest material is deposited near the water and larger material is found nearer to the cliffs at the back of the beach. Large material is deposited at the back of the beach in times of high energy, for example during a storm. Most waves break near the shoreline, so sediment near the water is more effectively broken down by **attrition**. Sandy beaches have **gently sloping** profiles and gravel while pebble beaches are **steeper**.

Spits

Spits are created by the process of longshore drift. Some eroded material ends up caught up within the waves and is carried by the sea along the coastline in cells known as littoral cells. Material is carried along the shore in a zigzag fashion by waves as they swash material up the beach at an angle and backwash material down the beach at a right angle. The angle of swash is determined by the prevailing wind (the dominant or main direction in which the wind blows).

Wherever there is a break in the coastline (e.g. across a river or a change in coastline direction) then material is deposited closest to the shore. This is because there are often counter currents and a loss in velocity, so material is dropped or deposited. Eventually this material builds up out into sea to form a spit.

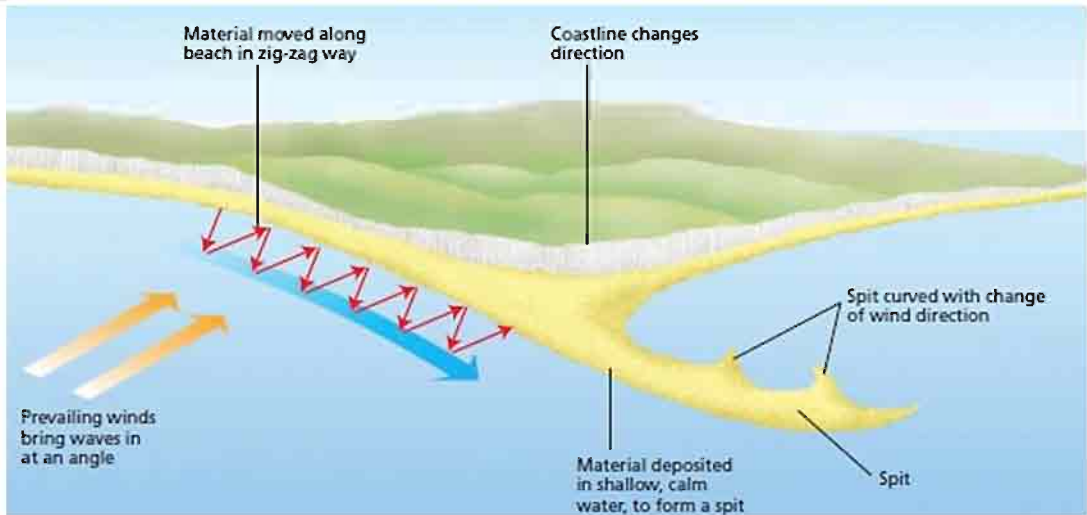


Figure 34. Formation of a spit

Salt Marshes

Salt marshes may be formed behind a spit. The zone behind a spit becomes a sheltered area. Water movement slows down and so more material is deposited. Deposition may form a salt marsh.

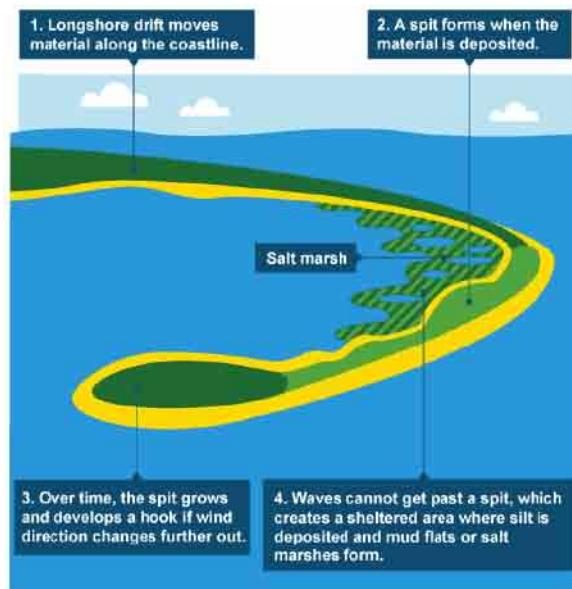


Figure 35. Formation of salt marshes

Progress Check



The following images represent all the depositional coastal landforms. In pairs, find out which picture represent which depositional coastal landforms.



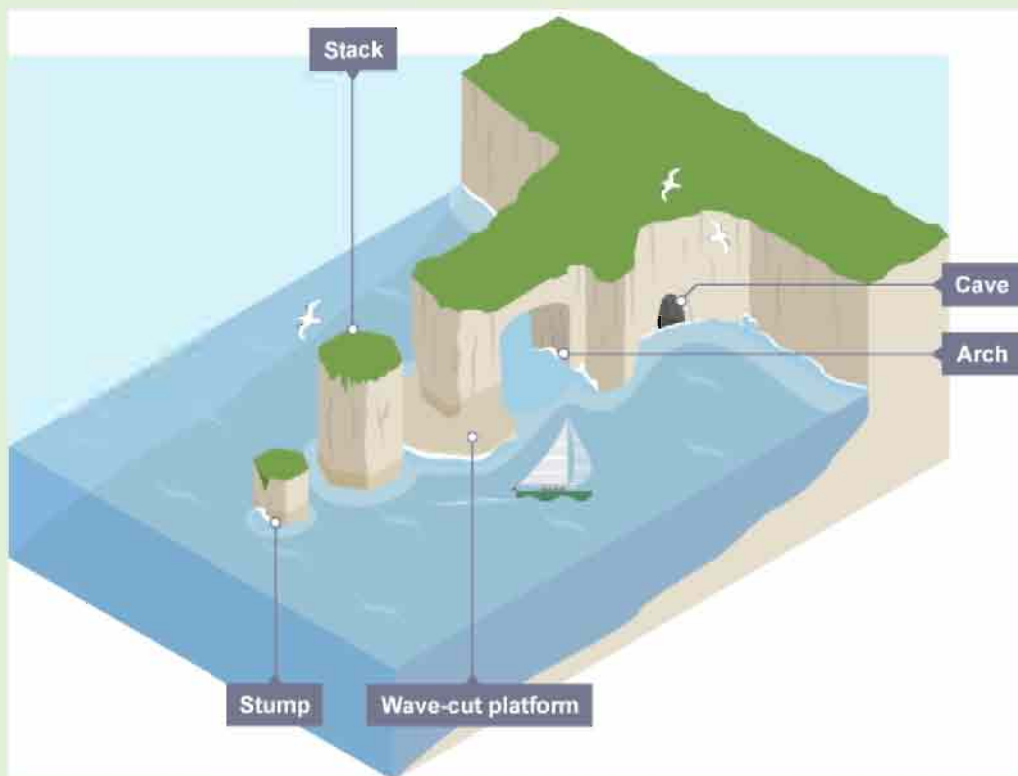
Spit, Bar, Natural Beach, Tombolo, Salt marshes



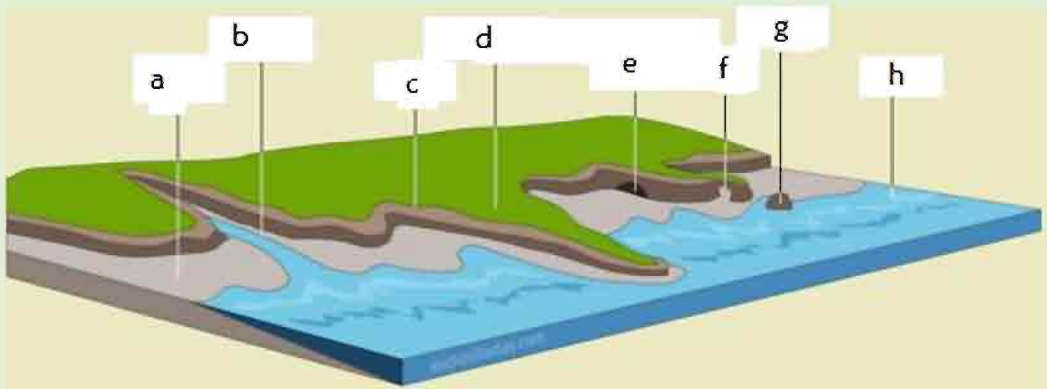
Exercise 2

Answer the following questions in pairs: (where possible, use models to explain your answer)

- a) Define the following terms:
 - a) Coasts.
 - b) Erosion.
 - c) Deposition.
- b) Differentiate the following terms:
 - a) Destructive waves and constructive waves.
 - b) Longshore currents and rip currents.
 - c) Headlands and bays
- c) State the two broad categories of coastal landforms.
- d) In **groups**, look at the illustration below. Explain how the coastal landforms, within the picture, are formed.



e) Name the coastal landforms in the picture below



f) In groups, **using models where possible**, discuss how the following landforms are formed:

- a) Wave-cut notches.
- b) Headlands.
- c) Bays.
- d) Beaches.
- e) Splits.
- f) Salt marshes.

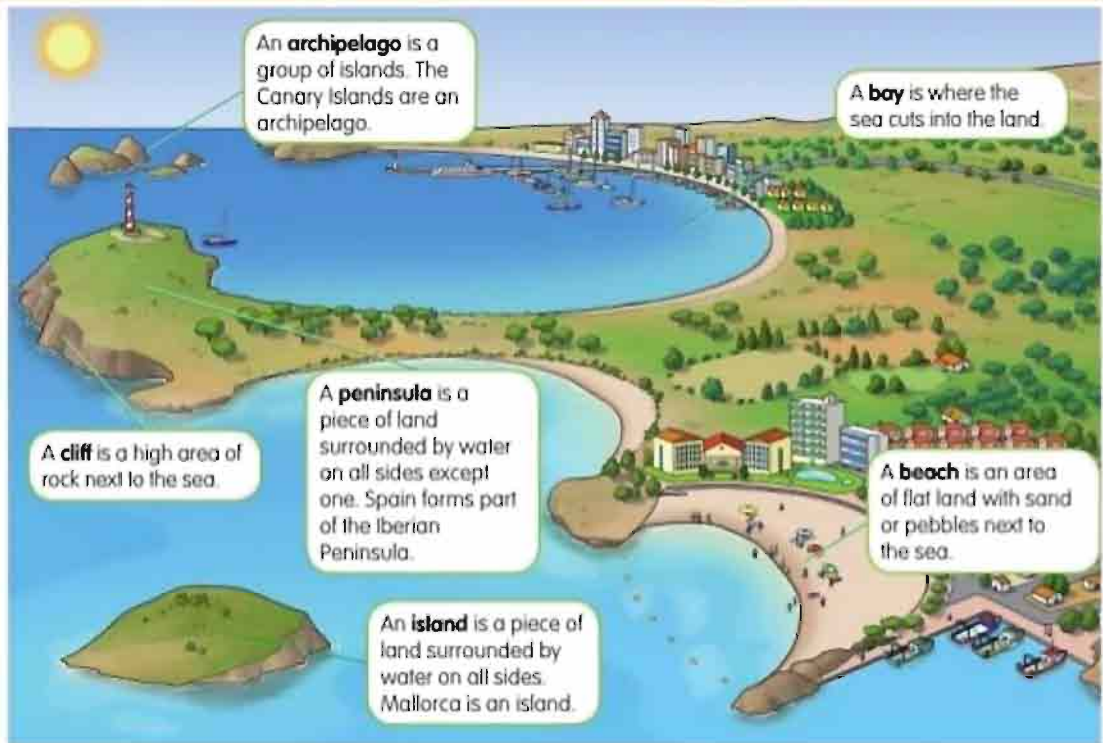




Case study 3

Importance of coastal landforms to humans

In groups, look at the picture below and answer the questions that follow:



- ✿ In pairs discuss the importance of beaches and bays to humans. Use appropriate examples.
- ✿ Using any reference material as instructed by your teacher explain how ocean tides affect the coast.
- ✿ At your own free time, read and make notes on how the following coastal features are formed:
 - a) Tombolo.
 - b) Bars.

Effects of seas and oceans on Global Climate

How do oceans and seas affect climate?

Oceans warm the planet

Radiation from the sun is absorbed by the ocean mainly in the earth's tropical regions. The Earth's atmosphere also helps to retain this solar heat that would otherwise be lost into space after the sun sets. The ocean stores radiation from the sun and distributes it globally from the tropics to the polar regions by winds and ocean currents.

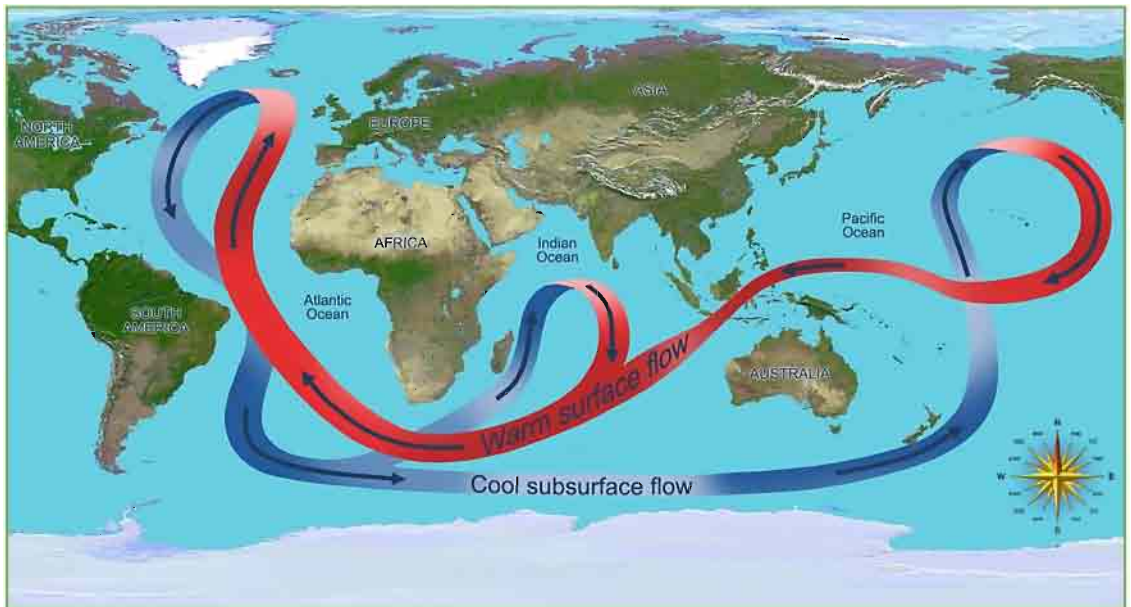


Figure 36. Ocean heat circulation

Oceans influence rain patterns

When ocean water is heated by the sun, it evaporates and is converted into water vapor which increases the temperature and humidity of the air, forming rain and storms. Rain is carried by winds to large distances around the world.

The ocean's role in creating rainfall is so important that nearly all rain that falls over the land comes from the ocean. Absorption of sun's heat and ocean evaporation are particularly high in the tropics, which receive more rainfall than any region in the earth

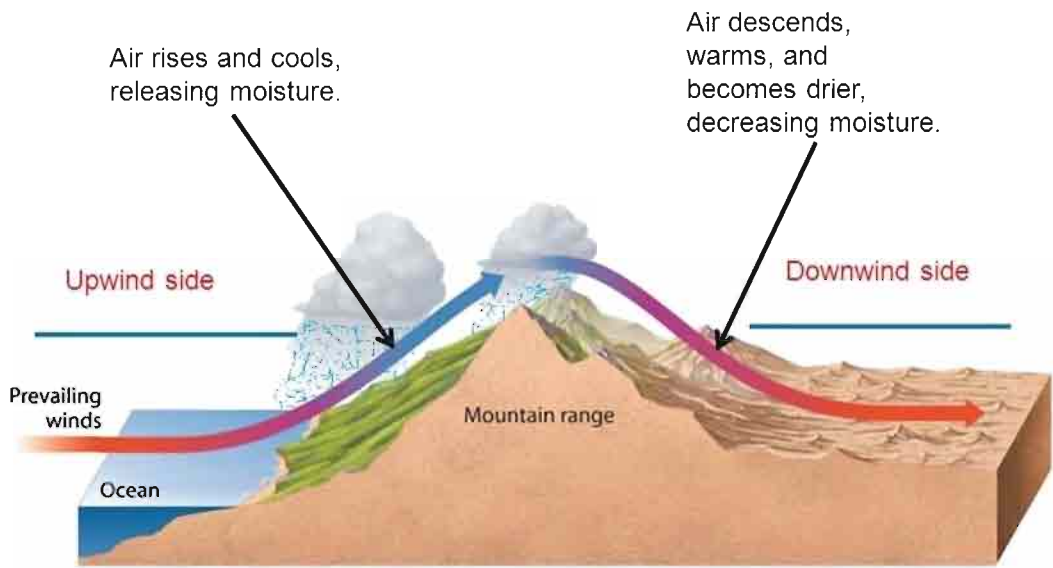


Figure 37. Role of seas and oceans in creating rainfall.

Photosynthetic organisms in the ocean influence the global climate

Half of the global carbon cycle is managed by photosynthetic organisms that dwell in the ocean such as phytoplankton, which produce oxygen and affect the levels of greenhouse gases (like carbon dioxide and methane) that are present in the ocean and in the atmosphere. The level of greenhouse gases in the atmosphere influences global temperatures and weather patterns because these gases absorb solar heat so efficiently.

Similarly carbon dioxide that is being produced by the burning of fossil fuels such as coal and oil is absorbed by the ocean.

Global weather patterns are controlled by ocean currents

Weather patterns are controlled by ocean currents, which are influenced by surface winds, temperature, the earth's rotation, and ocean tides. Ocean currents flow clockwise in the Northern Hemisphere and anti-clockwise in the Southern Hemisphere.

They bring warm water and rain from the equator to the poles and cold water from the poles toward the equator. These ocean currents help to neutralize the high levels of solar radiation that the earth's equator receive. Without these currents, it would be much hotter at the equator, much colder at the poles, and our planet's land would be much less habitable.

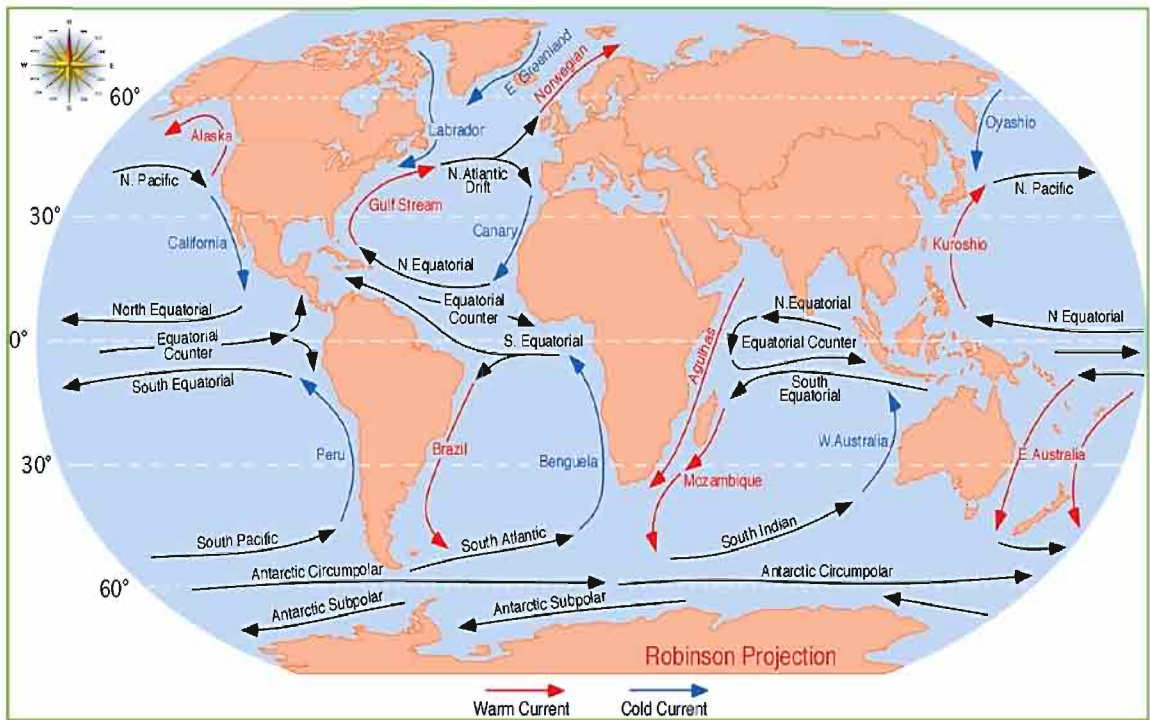


Figure 38. Global ocean currents.

Note: Climate change poses threats to the stability of ocean currents. If global Warming persists, sea and ocean levels will rise causing areas of low lying land to be at greater risk from coastal flooding and tsunamis.

Oceans influence regional climate

Oceans also influence the climate of various regions around the world. The difference in temperature between the land in the central region of a continent and the nearby ocean drives the development of monsoon winds. In the winter, cold air over a continent flows outward toward the ocean, and in the summer, the hot air over a continent draws moist air inland, leading to summer rains.

Cities located along coastlines also benefit from ocean breezes, a result of the difference in temperature between land and sea, where the land is cooler at night and warmer during the day.

Formation of land and sea breezes

A **land breeze** is created when the land is cooler than the water such as at night and the surface winds have to be **very** light. When this happens the air over the water slowly begins to rise, as the air begins to rise the air over the surface of the ocean has to be replaced, this is done by drawing the air from the land over the water, thus creating a sea breeze.

A **sea breeze** is created when the surface of the land is heated sufficiently to start air rising. As air rises, it is replaced by air from the sea; you have now created a sea breeze. Sea breezes tend to be much stronger and can produce gusty winds as the sun can heat the land to very warm temperatures, thereby creating a significant temperature contrast to the water.

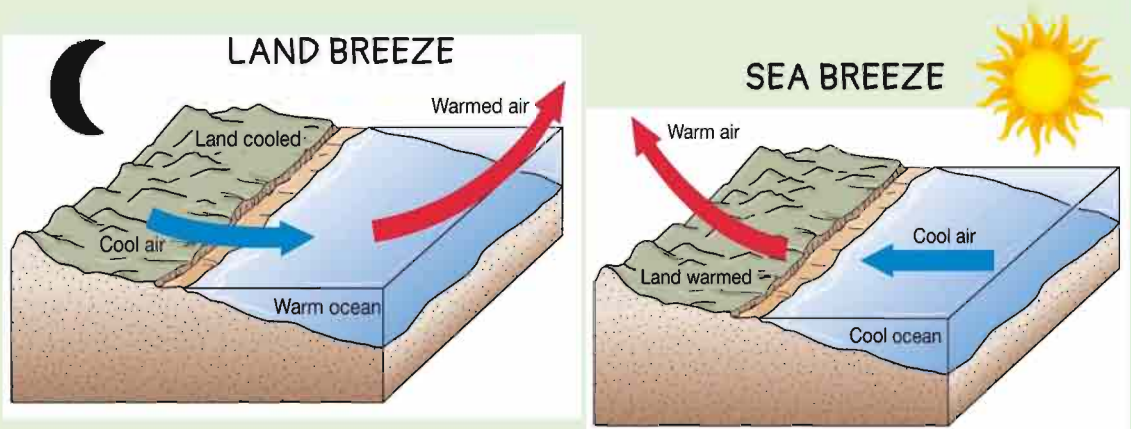


Figure 39. Formation of land and sea breezes.

Progress Check

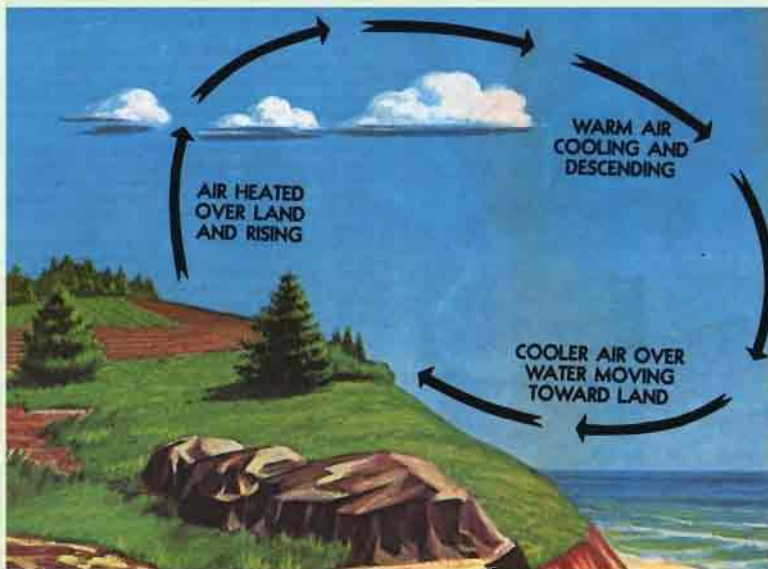


From the pictures provide below:

1. Justify the reason behind different temperature readings at Vancouver and Gressland.



2. Which type of breeze does the picture below represent? Explain.



Effects of global warming on polar ice caps

The Arctic and Antarctica ice caps help to cool sea and air temperatures, by reflecting the sun's radiation back into space, cooling the earth when winds and ocean currents swirl over and under it. They play a key part in the global climate system.

When temperatures rise and ice melts, more water flows from glaciers to the seas and ice caps, leading to ocean water warming and expanding in volume. Melting of the ice caps results in rising of the sea and ocean levels.

Progress Check



Look at the graphical information below. With reasons, estimate the global ice cap levels in the next 21 years.

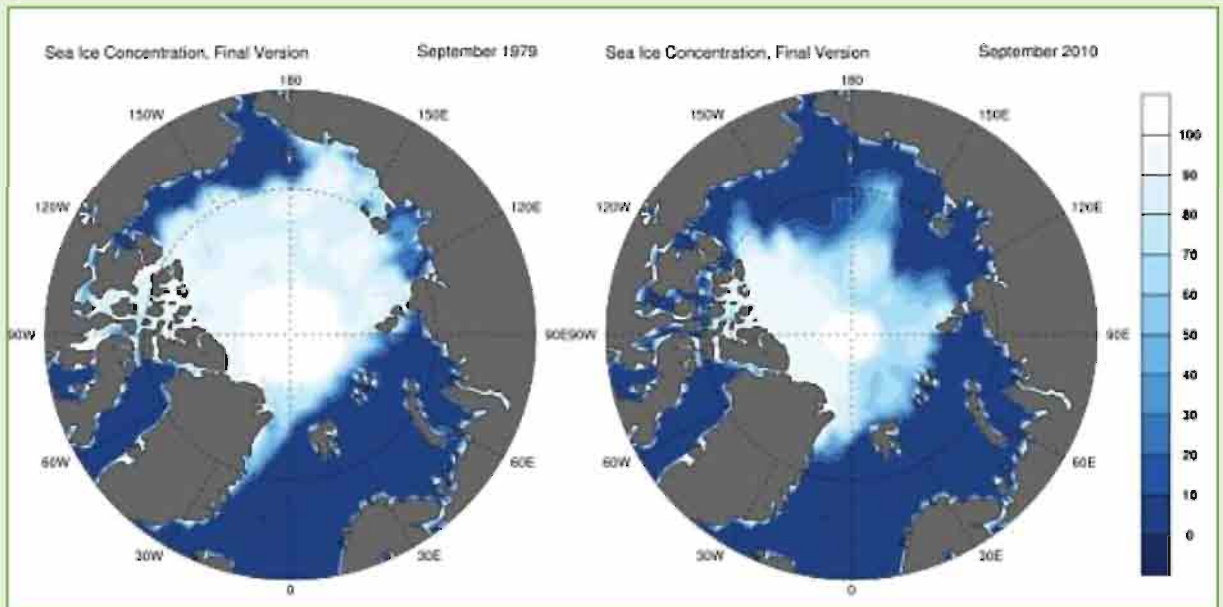


Figure 40. Polar ice levels as from September 1979 to September 2010

Similarly, melting of the polar ice poses a threat to major towns positioned on coastal regions. If the ice cap continues to melt on a quicker pace, the following could happen:

1. **Low fish production:** Fishing industries around the globe will have low fish production due to rise in the sea levels.
2. **Erosion of major beaches:** water from the sea will erode and cover most of the ocean and sea beaches. This might negatively affect the tourism industry of countries depending on them.
3. **Flooding of the coast:** rising of sea levels means increased water in the sea. Town around the coast will be flooded.
4. **Uncontrollable climate change:** the polar regions of the earth will face unusual, overwhelming and catastrophic climatic changes that will have irreversible effects on the surrounding ecosystems. Melting of the ice caps in the north and South Pole poses a threat to the existing biodiversity. Animals that depend on the arctic tundra are now threatened to extinction



Figure 41. The polar bear, the penguin and the seal are some of the creatures living in the Polar Regions that face threats of extinction.

Currently there is nothing we can do to reverse the damage that global warming has done to the polar regions of the earth. The best method to prevent any further damage is by conserving the environment.



Case study 4

Preventing effects of global warming on ice caps

- ✿ In **groups**, discuss some ways of preventing the effects of global warming on the Earth's polar ice caps.
- ✿ What would happen when all the ice in the Earth's Polar Regions melt away?



Economic importance of Seas and Oceans

Oceans are the lifeblood of planet Earth and humankind. They flow over nearly three-quarters of our planet, and hold 97% of the planet's water. They produce more than half of the oxygen in the atmosphere, and absorb the most carbon from it.

No matter how far from the shore that you live, oceans still affect your life and the lives of your families and friends, classmates and colleagues.

The following are some of the economic importance of oceans and seas:

Seas and Oceans are a means of transport

Oceans cover most of the earth's surface and each continent is linked by a different type of ocean and sea. Countries transport their exports and imports in bulk on huge ships. However, transportation by sea takes a very long time hence not suitable for perishable goods.

Land locked countries do not have access to oceans and seas but instead benefit from countries near oceans through other forms of transport such as rail, road and air. This may in turn rise the economies of countries bordering such waterbodies.



Figure 42. Different forms of sea transportation.

They are tourist attraction sites

The beautiful beaches and coral reefs near oceans and seas are a home for different plant and fish species. Tourists like basking in warm and calm coastal regions located near the equator such as the African coasts of Dar-es-Salam and Mombasa.



Figure 43. Left, tourists near the coastal beach of New York, USA and right, a scuba diver swimming past different species of fish near beautiful coral reef.

They offer biodiversity

Young aquatic organisms and make coral reefs and estuaries their home because they can find plenty of food and excellent protection from predators. All the aquatic organisms that live around coral reefs depend on each other for survival.

In the estuary, the seagrasses provide protection to young sea organisms and food for herbivores. **Mangroves** not only act as nurseries for important marine species, but also act as a filtering system for coastal water. Seagrass beds, mangroves and coral reefs are crucial to providing protection against shoreline erosion and flooding. The sandy shores are home to crabs and burrowing worms, as well as a feeding ground for birds. Without coral reefs and estuaries, our oceans would lose many organisms that are important to both humans and other marine life.

They possess a great amount of natural resources

Despite oceans and seas possessing great amount of fish, Ocean and sea floors have many important minerals, including oil and natural gas. Countries near major oceans and seas have built oil extractions and refinery plants. However oil spill in oceans and seas pollute the marine ecosystems killing all the diverse marine plants and animal species.



Figure 44. Oil drills near the coast of Pacific Ocean, USA



Exercise 3

Answer the following questions:

1. What is the difference between an ocean and a sea?
2. How do oceans affect climate?
3. Using a well-drawn and labelled diagram, explain the difference between land and sea breeze.
4. Discuss how global warming affects polar ice caps.
5. What are the economic importance of seas and oceans?
6. How can you relate the importance of Seas and Oceans to the lakes and rivers located in South Sudan?

Sustainable use of Seas and Oceans

What is sustainable development?

“Sustainable development is development that meets the needs of the present without compromising the needs of the future generations to meet their own needs” – Brundtland (1987).

Effects of Human activities on seas and Oceans

The ocean helps create and regulate weather around the globe and produces many of life's essentials, including water, food, and even the oxygen we breathe every day. However, there are consequences on how we use oceans and seas.

Oil spills

Oil spill originate from tankers and oil drills in oceans and seas. Spilled oil can harm living things because its chemical elements are poisonous. This can affect organisms both from internal exposure to oil through ingestion or inhalation and from external exposure through skin and eye irritation. Oil can also choke some small species of fish or invertebrates and coat feathers and fur, reducing birds' and mammals' ability to maintain their body temperatures.



Figure 45. Left, an oil spill in wales, England and right, people cleaning the mess from an oil spill in the Gulf of Mexico.

Marine pollution

Many ocean pollutants are released into the environment far upstream from coastlines. Nitrogen-rich fertilizers applied by farmers inland, for example, end up in local streams, rivers, and groundwater and are eventually deposited in estuaries, bays, and deltas. These excess nutrients can lead to the growth of enormous blooms of algae that raid the water of oxygen, leaving areas where little or no aquatic life can exist.

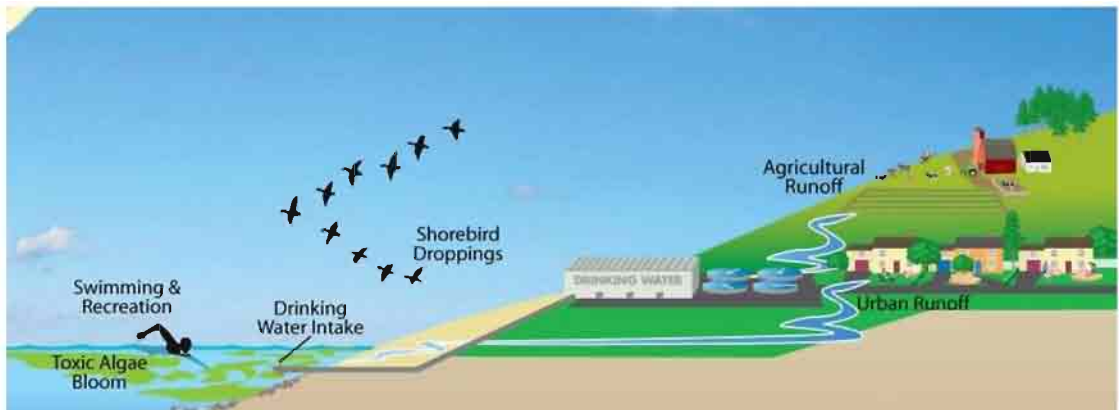


Figure 46. Factors leading to growth of algal blooms.



Figure 47. A dead fish in an algal bloom

Solid waste like bags, foam, and other items dumped into the oceans from land or by ships at sea are frequently consumed, with often fatal effects, by marine mammals, fish, and birds that mistake it for food. Discarded fishing nets drift for years, trapping fish and mammals.



Figure 48. Marine pollution

Overfishing

This occurs when more fish are caught than the population can replace through natural reproduction. Gathering as many fish as possible may seem like a money making practice, but overfishing has severe consequences. The results not only affect the balance of life in the oceans, but also the social and economic well-being of the coastal communities who depend on fish for their way of life.

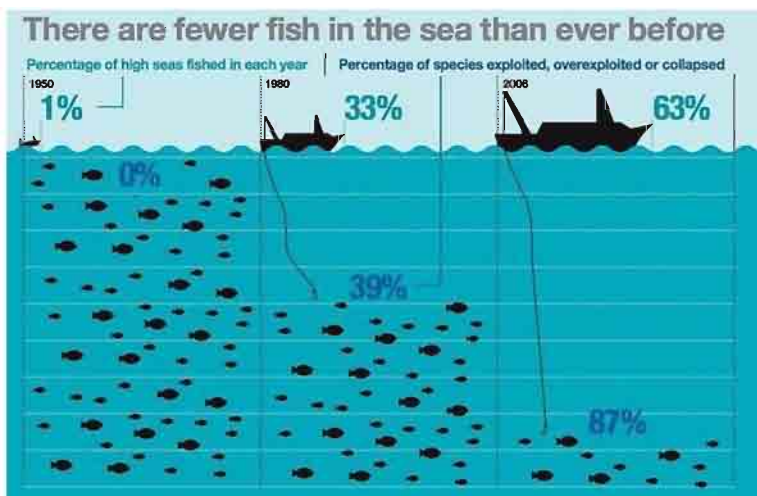


Figure 49. A graphical data representation of global overfishing

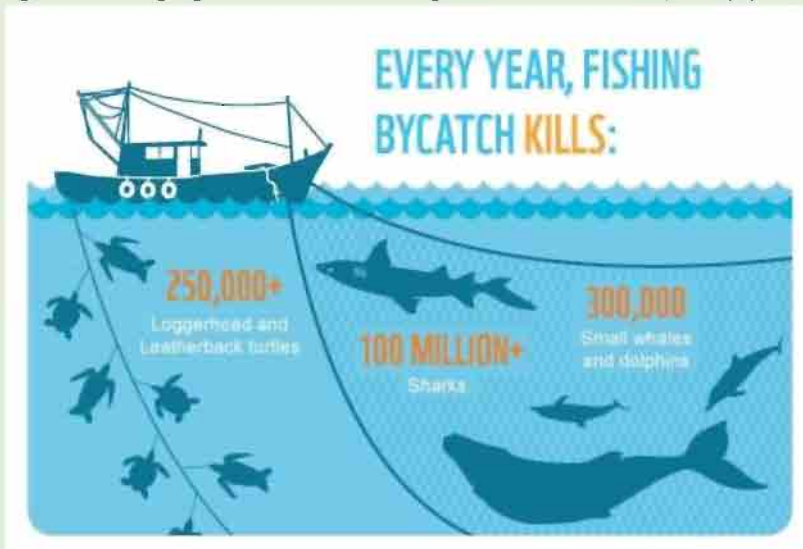
Progress Check



1. Discuss ways to prevent oil spills in seas and oceans.
2. An oil drilling company has been notorious for spilling used oil at a beach neighbouring Mr. Otim's home. Help Mr. Otim write a letter expressing his concern against the actions of the oil drilling company on the coastal environment.



3. Discuss the effects of algal bloom to the coastal environment.
4. In your own opinion, how can fishermen living around seas and ocean prevent overfishing? Use the graphical information provided below to justify your answer.



5. Design a poster campaigning against overfishing. In the poster place a brief information on the effects of overfishing to educate local fishermen.

How seas and oceans can be used sustainably

The following are some of the ways that we can help save the Earth's seas and oceans from marine pollution.

Exploring aquaculture

Aquaculture, also known as fish or shellfish farming, refers to the breeding, rearing, and harvesting of plants and animals in all types of water environments including ponds, rivers, lakes, and the ocean. Aquaculture avoids overfishing by first breeding young fish species to mature ones then harvesting them for economic and domestic use. There are two types of aquaculture:

1. **Marine aquaculture:** refers to the culturing of species that live in the ocean.
2. **Freshwater aquaculture:** produces species that are native to rivers, lakes, and streams. Such species include Tilapia, Nile perch and catfish among others.



Figure 50. Marine and freshwater aquaculture.

Reduce on use of artificial fertilizers.

Artificial fertilizers are the main cause of algal bloom which are organisms that can severely reduce oxygen levels in waterbodies, killing marine life. Algal blooms have a short life span of less than a year. After the bloom dies, the microorganisms which decompose the dead algae use up even more of the oxygen. When these zones of exhausted oxygen cover a large area for a long period of time, they are become dead zones, where neither fish nor plants are able to survive.

Algal bloom not only affect fisheries but also the tourism industry. They are toxic and harmful to human health. Farmers are to be encouraged and sensitize on the use natural of fertilizers to reduce on the effects of algal bloom on oceans and seas.



Figure 51. Volunteers cleaning the damage caused by algal bloom at the coast of China.



Case study 5

Sustainable use of oceans and seas

- 🐞 What is the sustainable use of seas and oceans?
- 🐞 What are the effects of marine pollution to aquatic plants and animals?
- 🐞 Explain how seas and oceans affect the shape of the land.
- 🐞 What are the effects of man's activities to coastal regions?
- 🐞 What are some of the possible suggestions to marine pollution?

Unit 3

COASTAL AREAS

Development in coastal towns

Are coastal areas favoured for development?

Coastal areas have attractive scenery

Major coastlines in the world have beautiful cliffs and rocks that are formed due to erosion of the land by tidal waves from seas and oceans. Additionally, areas around the coast have plenty of coral reefs that are home for different aquatic species. Coastal areas have beautiful beaches that attract tourists.



Figure 52. Right, a coastal cliff and left, a coral reef with different aquatic organisms.

They have natural and manmade harbours

A harbor is a region where ships, boats, seek shelter from stormy weather. Natural harbors are formed from flooded river valleys around the delta region of oceans and seas. They have long been of great strategic naval and economic importance, and many great cities of the world are located on them. They are important for fishing and ship or boat anchoring.



Figure 53. Sydney harbour in Australia is an example of a natural harbour

Man-made harbours also known as **ports** are man-made facilities built for loading and unloading vessels and dropping off and picking up passengers. They are constructed by **dredging**, which is a process of displacing rock and soil deposits near coastal regions. Ports usually include one or more harbors. Ports are important in the economy of a country.



Figure 54. Right, a dredger removing soil and rock deposits around Long Beach Harbour, California USA. LEFT, ships on the Port of Long Beach.

Coastal areas have valuable natural resources

Mangroves around coastal regions act as a form of shelter for many wildlife animals such as crocodiles, birds, monkeys and fish. The coral reefs on the other hand are mainly habitats for fish and other crustaceans. These animals, especially the fish, are an important diet to the locals and they may suffer great problems without a source of food if the mangroves and coral reefs were to be destroyed. Moreover, the mangroves maintain the coastal water quality by removing pollutants from land-based sources. They also act as a natural buffer, thus making the coast less vulnerable from floods and through this protection, decreasing the rate of erosion.



Figure 55. Mangroves forest in Kiunga, Mombasa Kenya

Beaches and equable climate offer potential for recreation and tourism

Coastal areas have slightly warmer temperatures in winter and cooler ones in summer than corresponding areas of the same latitude. The reasons for this are due to the fact that water takes longer to heat up than the land but takes much longer to cool down than land due to the fact that water's specific heat capacity is much higher than that of land. Beaches around the coastal areas provide recreational opportunities for tourists such as [sun basking](#), [surfing](#) and [swimming](#).



Figure 56. Recreational activities in coastal areas.

Coastal areas support urban growth

Areas around river flood plains and deltas are more favourable for urban growth since they have a flat land topography rich with nutrients for farming. Not only do coastal areas have farming as their source of food but also fishing. Fishing is a major economic activity in coastal areas. Both the soil's fertility and food from fishing encourage people to live on the deltas, leading to large urban growth. An example of coastal areas rich in agriculture and fishing is the Nile delta in Egypt.



Figure 57. Fishing and farming in the Nile delta Egypt.

Industrial and port development in coastal areas

The presence of natural resources of coastal regions has facilitated growth industries and ports. The need for importing and exporting of goods to and from a country leads to expansion of already built harbours. Landlocked countries depend on countries with coasts hence an increase in the development of coastal areas. South Sudan gets most of its imports from the Kenyan coast.

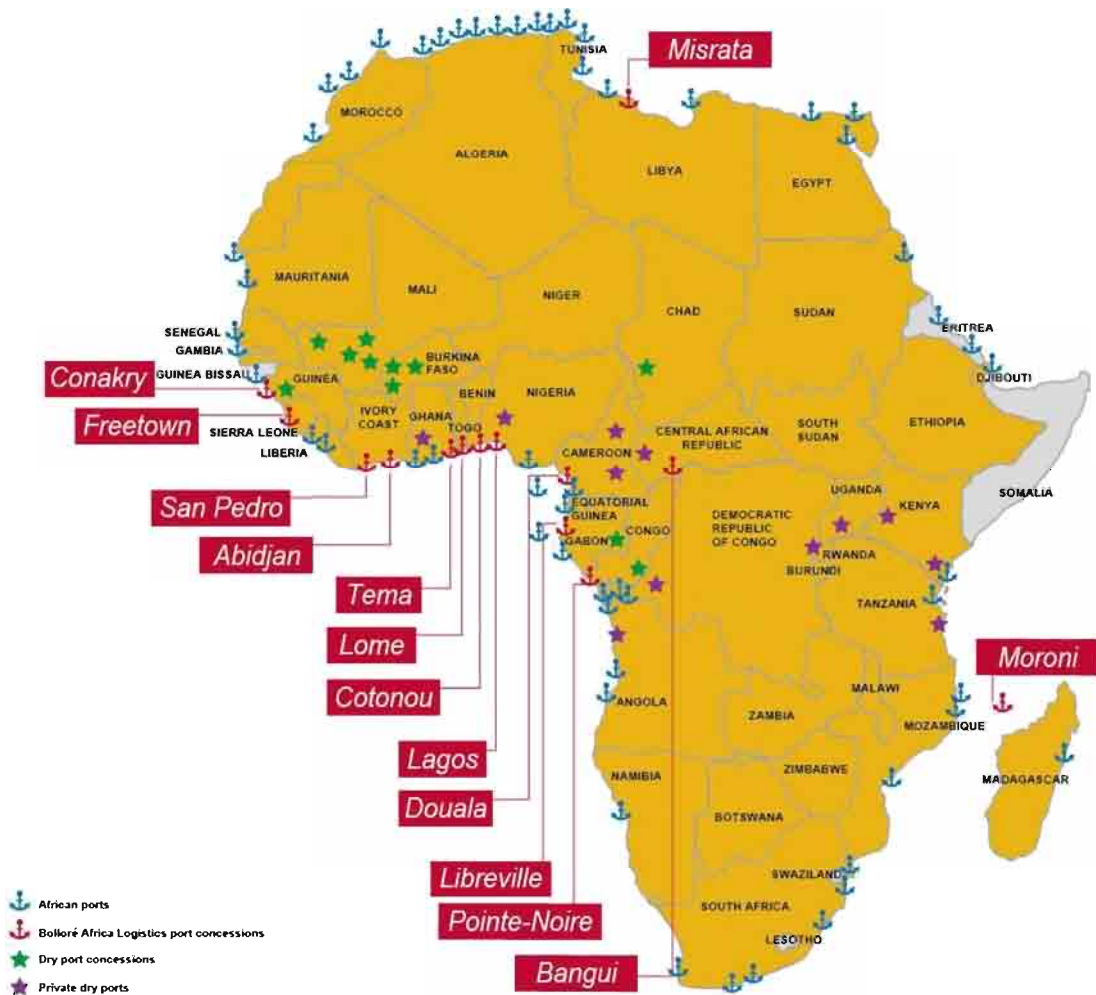


Figure 58. Major ports and harbours in Africa (2017)

Progress Check



In pairs, justify why the following regions represented on the photographs provided below are favoured or not favoured for development.



Development of coastal towns in East Africa

Mombasa

Mombasa is the second largest city in Kenya. Located on Kenya's Eastern coastline bordering the Indian Ocean, its original Arabic name is **Manbasa**. In Kiswahili, it is called "**Kisiwa Cha Mvita**", which means "**Island of War**" due to the many changes in its ownership.

During the precolonial period, Mombasa was a major harbour for the transportation of trade goods and slaves. Its influence by various communities around the globe led to the growth of Mombasa Town which is now Kenya's second city.

The city remains one of Africa's major links to the rest of the world. Built on a 15 sq. km island, Mombasa is surrounded by a **natural harbor**. The mainland coasts north and south of the city boast a proliferation of tourist resorts. Major ports in Mombasa includes the **Kilindini port** and **Lamu** which is currently under construction.



Figure 60. Kilindini harbour and the port of Lamu.

Dar-es- Salaam

The **Port of Dar es Salaam** is the principal port serving Tanzania. The port is one of three ocean ports in the country and handles over 90% of the country's cargo traffic. It is the fourth largest port on the African continent's Indian Ocean coastline after Durban, Mombasa and Maputo. The port acts as a gateway for commerce and trade for Tanzania and numerous bordering landlocked states.



Figure 61. The Port of Dar-es Salaam



Case study 6

The importance of East African ports on south Sudan (Group Discussion and Presentation)

South Sudan is a landlocked country. In **groups** discuss how East African ports are important to the economy of South Sudan and other landlocked countries such as Uganda, Rwanda and Burundi.

Coastal Management

What is coastal management?

Successful management of coastal areas depends on understanding the different uses of coastal land and the physical processes impacting on the coast, such as erosion and longshore drift. It also involves representing the interest and need of each coastal user in order to avoid **human conflict**.

Coastal conflicts

There are various other conflicts not just between development and conservation but also between conflict over who will have and exploit the land. In many respects, these users are competing with each other because of their special needs.

The main users and their reasons for the development of coastal areas are as follows:

- **Local Residents** – good choices of housing; clean environment.
- **Employers** – access to labour; space for shops, offices and factories.
- **Farmers** – well-drained land; shelter from strong onshore winds.
- **Fishermen** – harbours; unpolluted waters.
- **Port Authorities** – harbours and space for port-side services and terminals such as ports and airports.
- **Transport Companies** – good roads and terminal's such as ports and airports.
- **Tourists** – beaches, hotels, recreational amenities, heritage sites.
- **Real Estate Developers** – Greenfield sites.

Which of these reasons do you believe to be the most significant in relation to coastal development?

Each interest group may have a different view about what should be done to protect and manage coastal areas. A difference of opinion can cause **conflict** between interest groups. Issues such as **corruption** and **land crimes** among others are as a result of the conflict between coastal users.

How coastal pollution creates conflicts

Coastal regions attract many economic activities and this leads to increased population in coastal towns. These regions experience great environmental modification caused by land conversion, sea dredging, and water pollution from urban, industrial, commercial, and agricultural development.

Industrialization in the coastal area damages and destroys the natural environment. Similarly, there are developments taking place that are destructive to the tourism sector. Water around coastal areas is polluted by:

- The ships serving the oil and gas terminals.
- Discharges from industrial plants.
- The run off of agricultural chemical into the sea.



The success of tourism depends on clean beaches and clear seas. In terms of marine pollution, tourism is in conflict with at least three other activities. It is also in conflict with these same activities because:

- They are all competing for coastal sites.
- Tourist sites don't want to be located close to an oil refinery or a power station. It would be bad for their image and their tourist appeal.



Case study 7

Resolving coastal conflicts and providing solutions to coastal hazards (Group discussion and presentation).

Tackle the following investigative questions in groups:




-  What do you understand by coastal management?
-  What are some of the ways of resolving human conflict amongst coastal users?
-  In groups, investigate on how coastal environments are threatened by growing incidence of coastal hazards such as rapid erosion and rising sea levels and identify the steps of combating this. **(use any reference material available)**



Figure 62. Threats on coastal environments include flash floods, rapid erosion, cyclones, tsunamis, heavy storms among others.



Exercise 4

Answer the following questions:

1. Why are coastal areas attractive to developers?
2. How do coastal developments create competition and conflicts?
3. What are the challenges facing landlocked countries? Explain.
4. You are elected as a **leader of a landlocked country**. What can you offer as a solution to the challenges your country faces as a landlocked country?

Unit 4

GLOBAL ENERGY RESOURCES

Understanding Energy Resources

What is an Energy Resource?

An **energy resource** is something that can produce heat, power life, move objects, or produce electricity. Matter that stores energy is called a **fuel**.

Types of energy resources

Renewable energy resources

A renewable resource is a resource which can be used repeatedly and replaced naturally. Examples include **water**, **geothermal**, **wind**, **tidal**, **solar energy** and **biomass**. Renewable resources may include goods or commodities such as wood, paper and leather. Renewable energy resources do not pollute the environment or cause global warming.

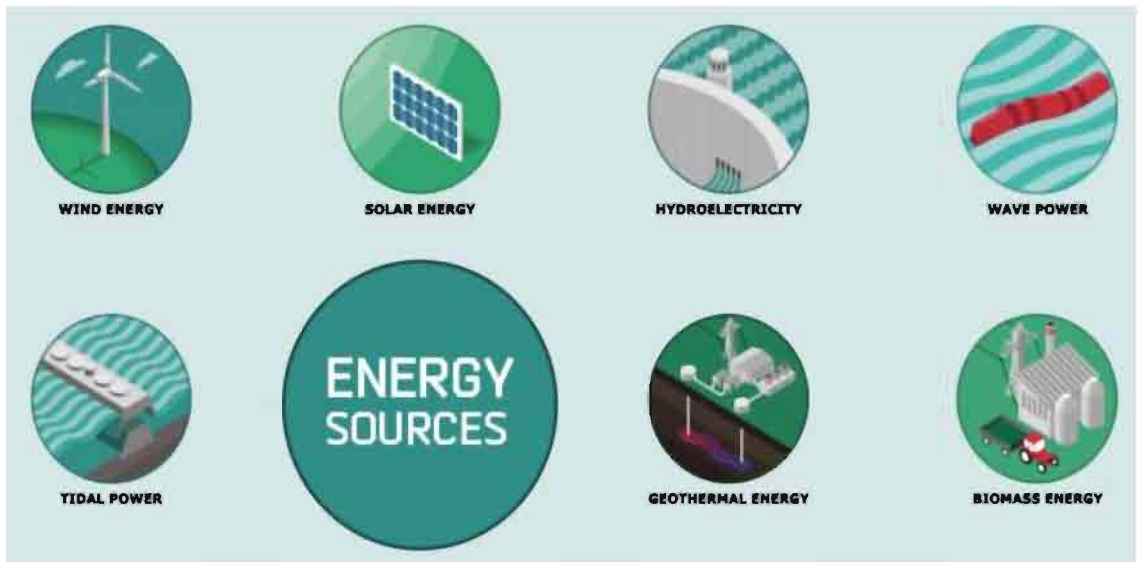


Figure 63. Renewable energy resources

Solar energy

Solar panels harvest light energy and convert it to electrical energy. However, a small amount of electricity is produced from sunlight, which does not exist throughout the day. So, solar energy is not capable of providing large amount of electricity as compared to hydroelectric energy. Developments in technology are encouraging variety in the usage of solar energy to promote a greener environment.

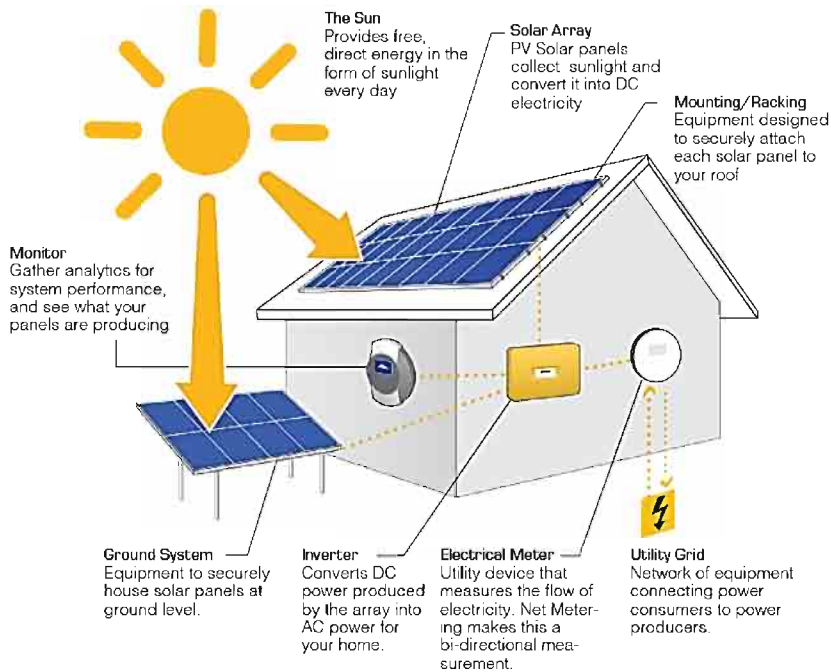


Figure 64. How solar energy works



Figure 65. Solar panels in the University of Juba, South Sudan

Hydroelectric energy (Hydropower)

This is energy harvested from the movement of water in water bodies such as streams and rivers. Hydroelectric power plants are also installed at constructed dams to utilize the force of the water bodies. Turbines are placed under water to gather the kinetic energy from the moving water. Large amount of electricity is produced in hydroelectric power plants. Hydroelectric power is the most common form of renewable energy resources. This form of energy can be used in South Sudan to produce electricity locally.

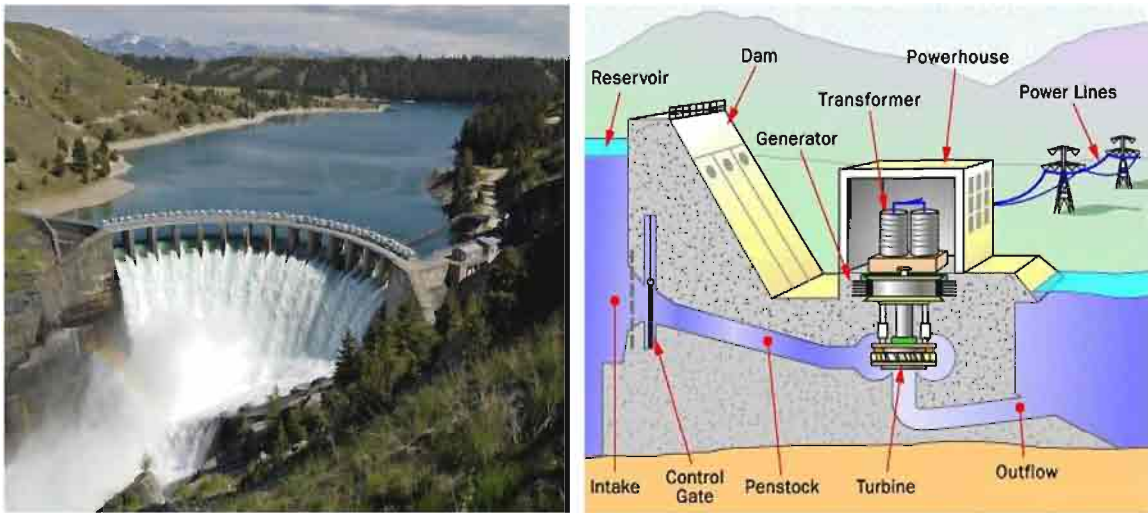


Figure 66. Left, Chollet Hydropower dam in Cameroon and right, a cross section diagram of how a hydropower dams works

Wind energy

Wind energy is harvested using wind currents to turn the fans of windmills which converts wind energy to electrical energy. One windmill can provide electricity to a small home. Windmills are usually used by farmers in rural areas where there is more space to set up a windmill. They also require region that experiences a windy climate.

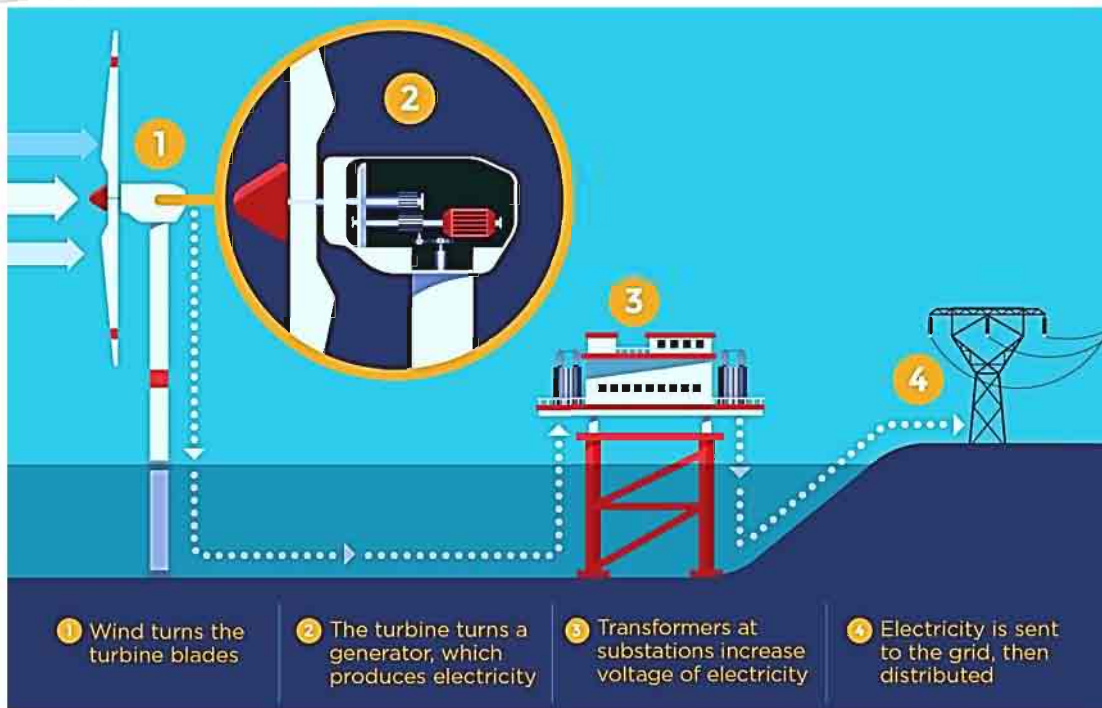


Figure 67. How wind turbines work.



Figure 68. Left, giant windmills in Morocco, North Africa and right, windmills in Ngong Hills, Nairobi, Kenya.

Biomass

Biomass is a collective term for biological wastes such as kitchen waste, animal waste and biological by-products of industries. This types of waste are used to produce bio fuels from which energy can be extracted. Unlike other forms of renewable energy resources, biomass is not limited to climatic conditions. Improvements in technology have made biomass fuels to power engines and generators. The following can be used in generating biofuel:

- **Grains and starch crops** – sugar cane, corn, wheat, sugar beets, industrial sweet potatoes, etc.
- **Agricultural residues** – Corn Stover, wheat straw, rice straw, orchard prunings, etc.
- **Food waste** – waste produce, food processing waste, etc.

The Biodiesel Cycle

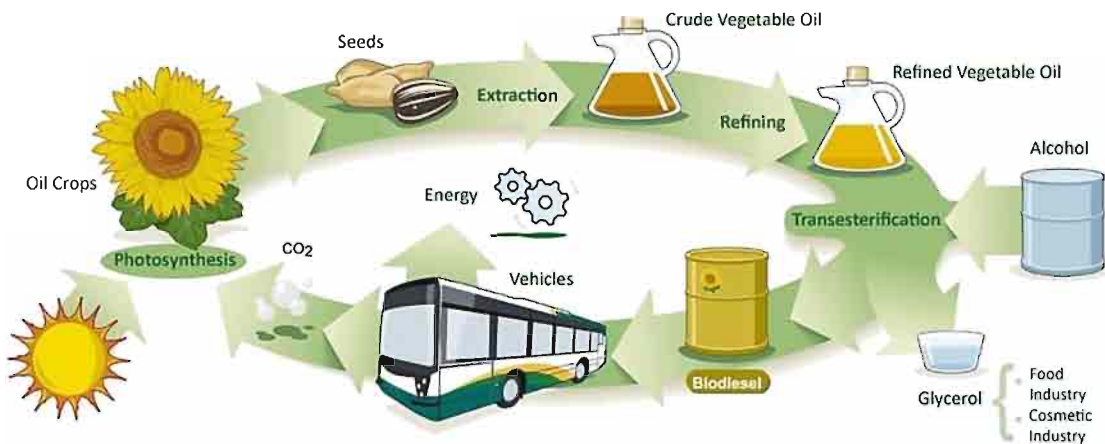


Figure 69. Bioenergy



Case study 8

Advantages and disadvantages of renewable energy

Tackle the following question in groups:

- What are the advantages and disadvantages of renewable energy resources?

Global distribution of renewable energy resources



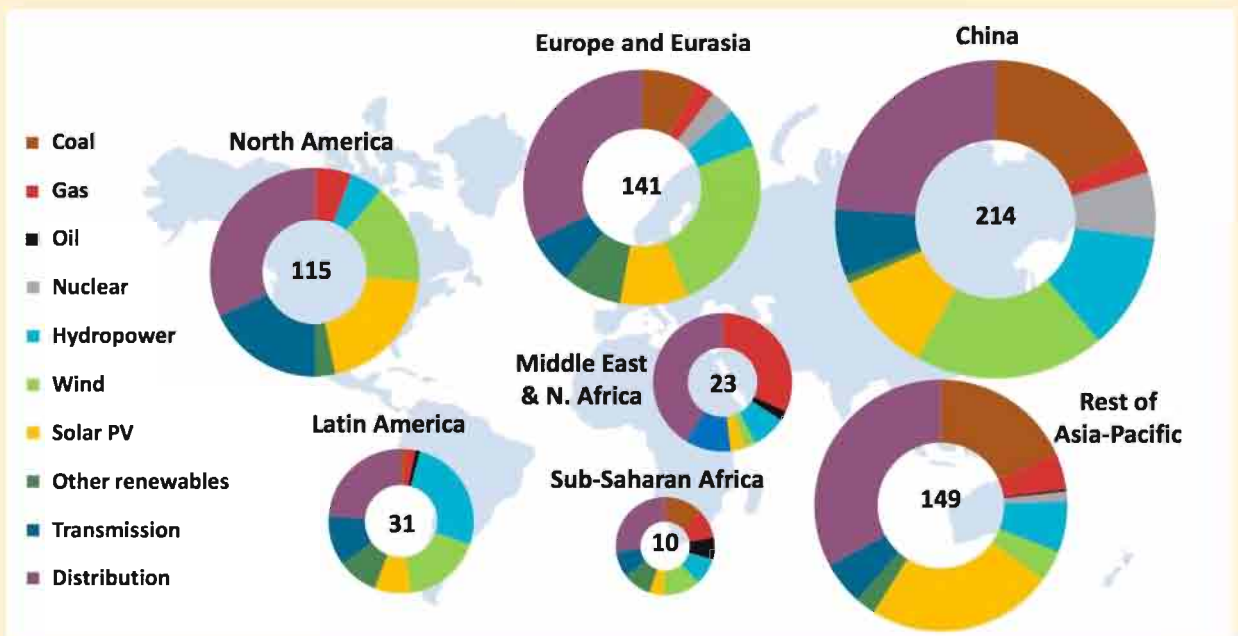
Each and every country in the world has renewable energy. However there is a variation in how nations of the world use the already available renewable energy resources.

Most nations in the world have concentrated more on the extraction of fossil fuels, leaving behind the renewable sources of energy. There however are some countries in the world that have harvested renewable resources in large scale.

Progress Check



Look at the graphical information provided below. How do energy sources compare across continent? Why do you think there are these differences?



Alta wind Centre, U.S.A

Alta Wind Energy Centre (AWEC) in Tehachapi, Kern County, California, is the largest wind farm in the world. It produces 1,020MW.



Figure 70. Alta wind Centre, Kern County, California U.S.A

Hydroelectric power (H.E.P) production in the World

China is the leading hydroelectric power producer in the world more and produces double the amount produced by Brazil, in second place followed by Canada the United States, Norway, Sweden, India, Venezuela and Japan. Here is a graph showing hydroelectric power production in the world.

Top Ten Hydroelectric Energy producers in the world

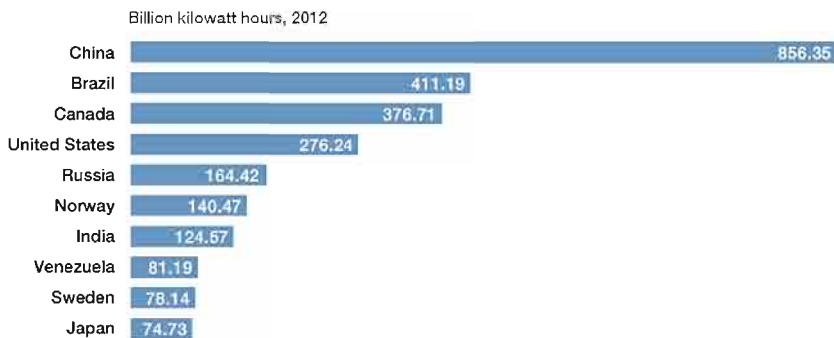


Figure 71. Top Hydroelectric producers in the world

Geothermal energy production in the World

Geothermal energy originates from the natural heat of the earth, and requires a 'carrier' (hot water or steam) at a shallow depth that can be drilled and pumped to produce heat or electricity (through a steam-driven turbine).

Geothermal energy contributes a tiny proportion of the world's primary energy consumption. Even in electricity generation, geothermal produces less than 1% of the world's output. However, for individual countries, such as the Philippines, which lacks indigenous fossil fuels, geothermal energy contributes materially to the nation's energy supply and wellbeing.

Turkey is the world's largest producer of geothermal energy followed by United States, Mexico, Kenya, Japan and Germany.

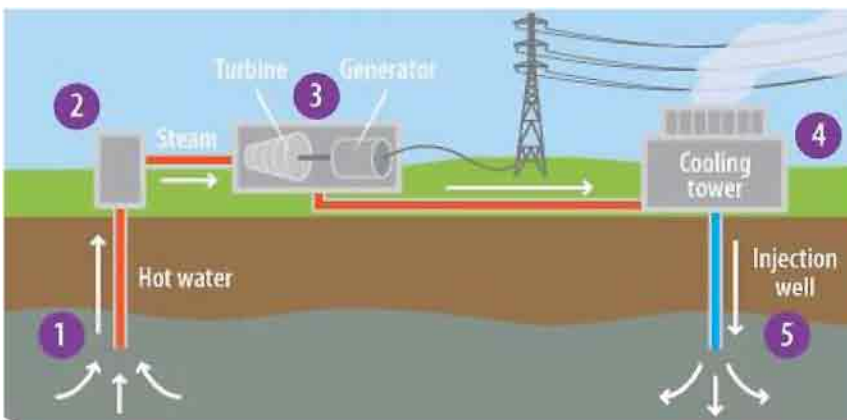


Figure 72. How geothermal energy works

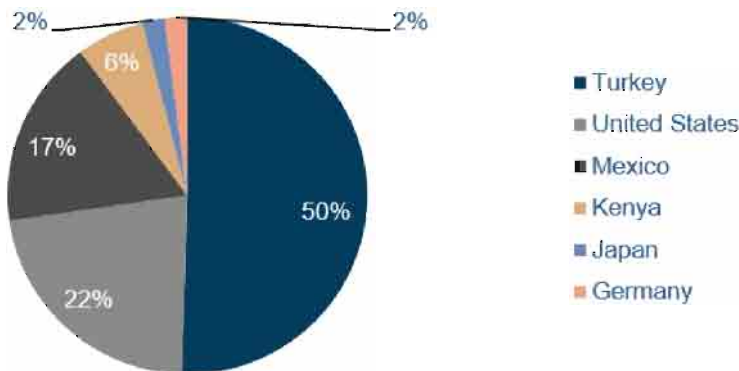


Figure 73. Geothermal energy production in the world (2017).

Renewable energy in Africa

In Africa, there are a significant amount of **hydroelectric** power plants, however electricity is only witnessed in areas near major towns and cities within Africa. In areas without electricity, solar energy and fuel powered generators are used.

Geothermal energy is abundant in parts of Kenya, Ethiopia, Eritrea, Tanzania, Democratic republic of Congo, Mozambique and Somalia.

Progress Check



Figure 74. Geothermal and hydroelectric power distribution in Africa

1. Can you estimate the number of people who have access to electricity in your locality?
2. Discuss the everyday challenges of not having access to electricity. How does it affect the economy, health and the environment?

Non-renewable energy resources

Non-renewable energy is energy produced by burning fossil fuels such as coal. They are non-renewable because there are limited resources of fossil fuels on the planet. If they are continually used, one day they will run out. Non-renewable fossil fuels include **crude oil**, **nuclear energy**, **natural gas** and **coal**

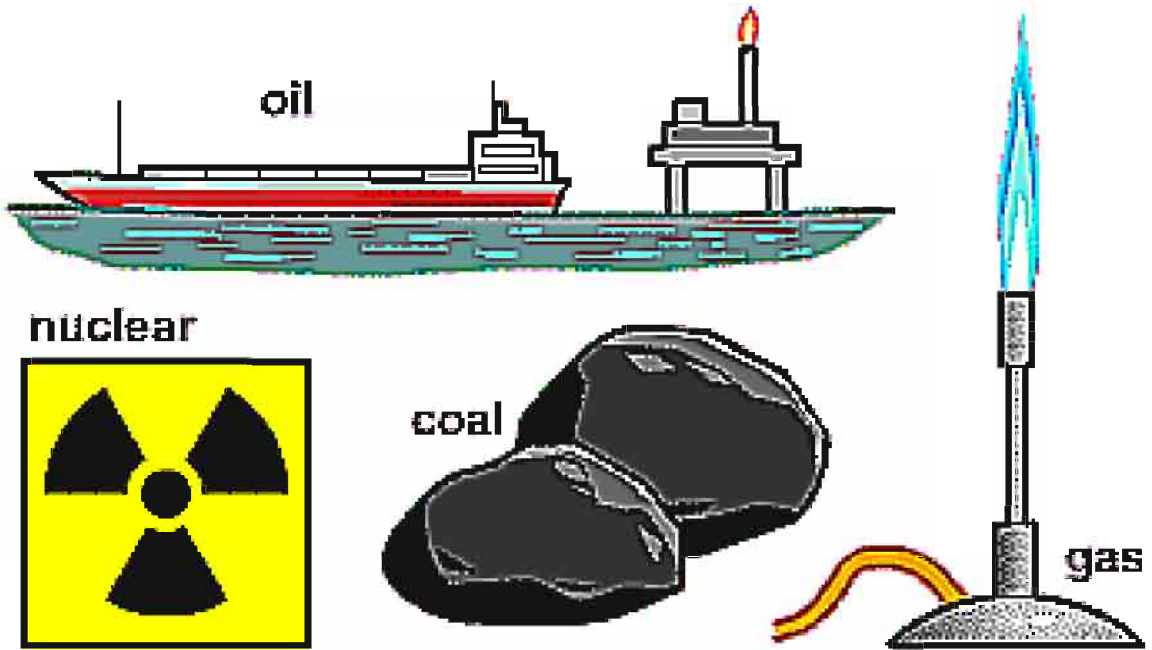


Figure 75. Forms of non-renewable resources.

Oil

Oil is the liquid fossil fuel and is often referred to as petroleum. Oil is found in the substance between rock layers or within rocks themselves. To retrieve the oil, a well is dug and the oil is pumped up to the surface. After crude oil is removed from the ground, it is sent to a **refinery** where different parts of the crude oil are separated into useable petroleum products. These petroleum products include gasoline, distillates such as diesel fuel and heating oil, jet fuel, petrochemical feedstock, waxes, lubricating oils, and asphalt.

Russia is the world's largest producer of petroleum followed by **Saudi Arabia**.

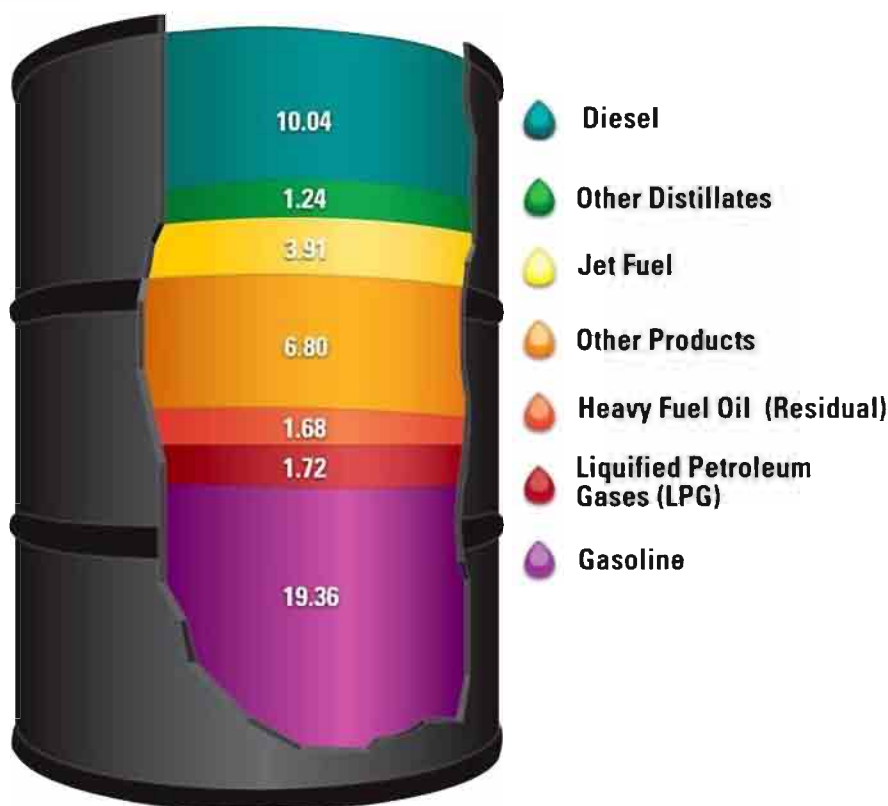


Figure 76. Products of oil made from a barrel of crude oil.

Coal

Coal is a flammable black hard rock used as a solid fossil fuel. It is mainly made up of carbon, hydrogen, Sulphur, oxygen and nitrogen. It is a sedimentary rock formed from ancient plants and animals accumulating in moist mulch marshes. As plants die off in a wet area, they pile up into peat. It takes a long time for peat to accumulate. This process happens mostly in river deltas or coastal plains.

Over time, these peat seams are compressed by further deposits and the carbon content of the coal is concentrated. The older the coal gets, generally, the harder and blacker it gets. There are four "ranks" of coal: [lignite](#), [subbituminous](#), [bituminous](#), and [anthracite](#) (from lowest to highest.) Rank is determined by energy content and chemical composition.

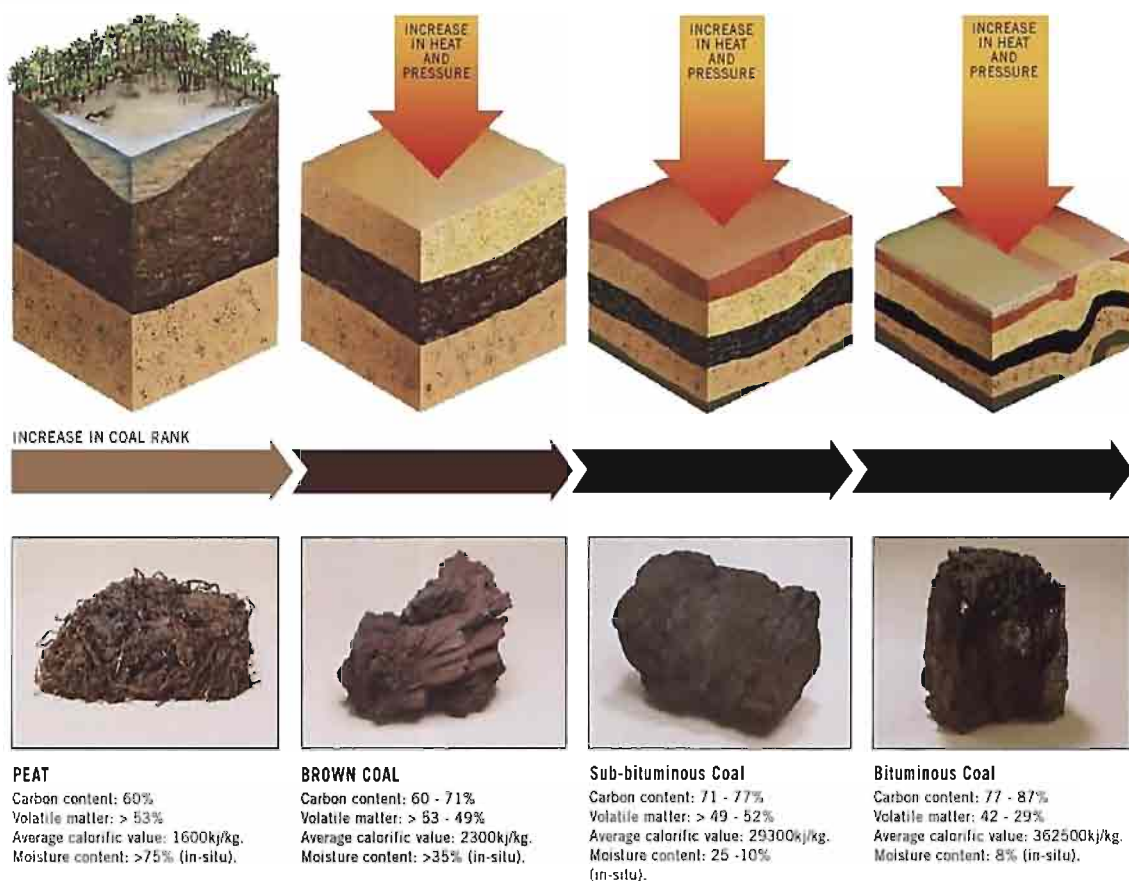


Figure 77. Formation and types of coal.

Coal mining requires a lot of energy, labor and money. Coal is mined both on the surface and underground. However, underground mining is one of the most hazardous of occupations, killing and injuring many in accidents, and causing chronic health problems.

Coal can be burned for energy or heat. A greater percentage of coal mined today is burned in coal power plants to produce electricity. Coal is becoming less popular in new power plants as less expensive and less polluting technologies such as natural gas and hydroelectricity take over. Coal can be heated in high temperature in a place where there is no oxygen to produce **coke**. Coke is even better fuel than coal, and can be used in smelting to reduce metals from their ores.



Figure 78. A coal mine in Australia.



Figure 79. Ferry bridge coal power station In England, United Kingdom.

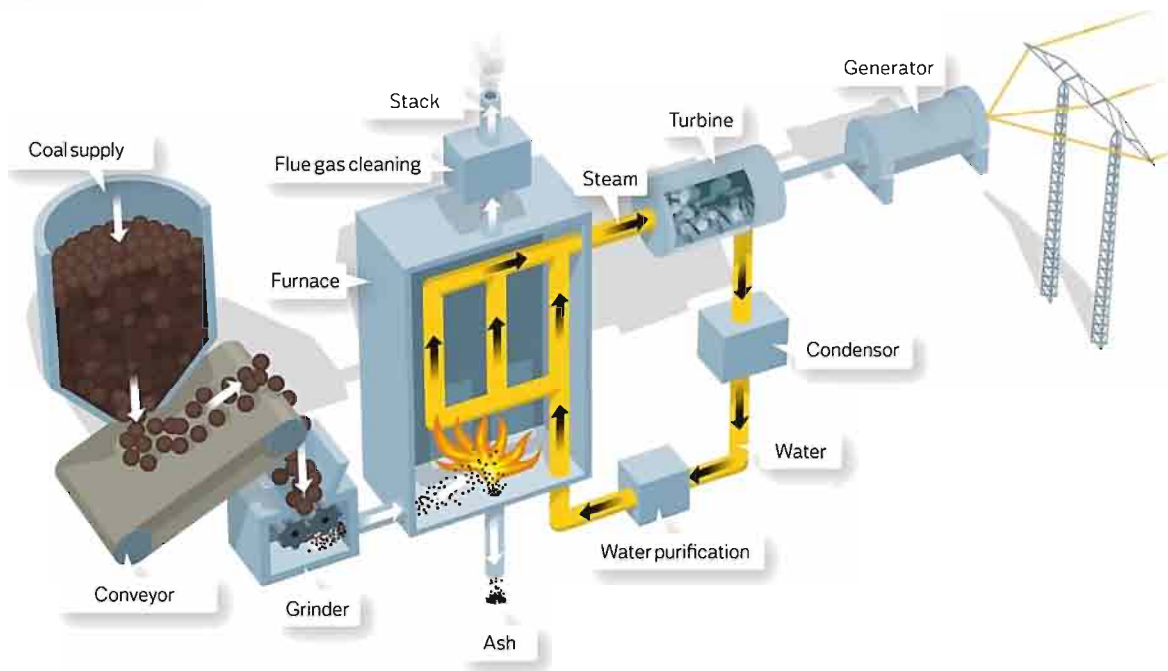


Figure 80. How a coal power plant works.

Natural gas

Natural gas is a naturally occurring hydrocarbon gas mixture consisting primarily of **methane**, but commonly including varying amounts of other higher alkanes, and sometimes a small percentage of carbon dioxide, nitrogen, hydrogen sulfide, or helium.

It is formed when layers of decomposing plant and animal matter are exposed to intense heat and pressure under the surface of the Earth over millions of years. The energy that the plants originally obtained from the sun is stored in the form of chemical bonds in the gas.

Natural gas is a fossil fuel used as a source of energy for heating, cooking, and electricity generation. It is also used as a fuel for vehicles and as a chemical feedstock in the manufacture of plastics and other commercially important organic chemicals. Fossil fuel based natural gas is a non-renewable resource.

United States of America (USA) is currently the world's largest producer of natural gas followed by **Russia**.

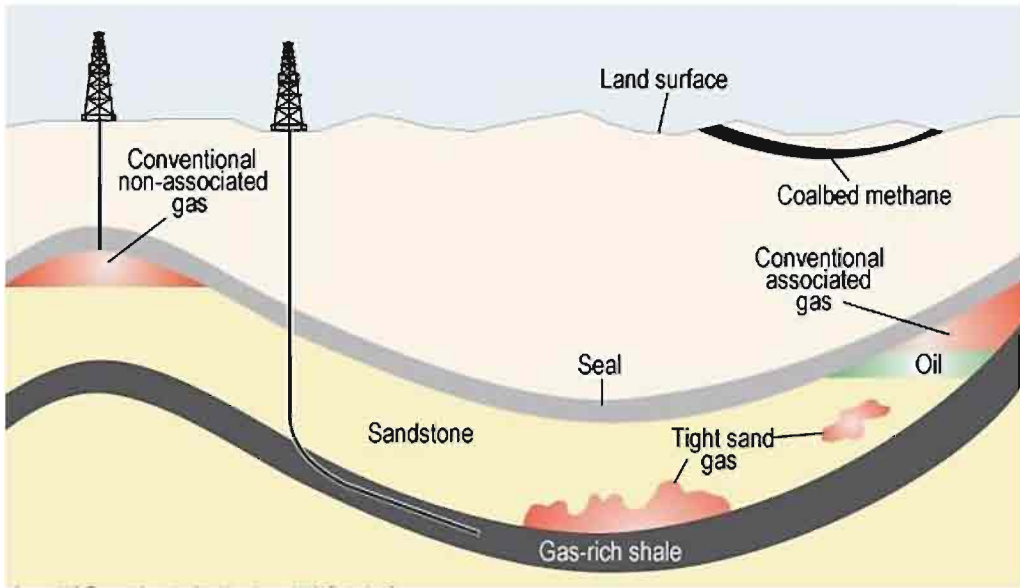


Figure 81. Extraction of natural gas

Progress Check



From the map provide below, how could you explain the variations in global natural gas production?

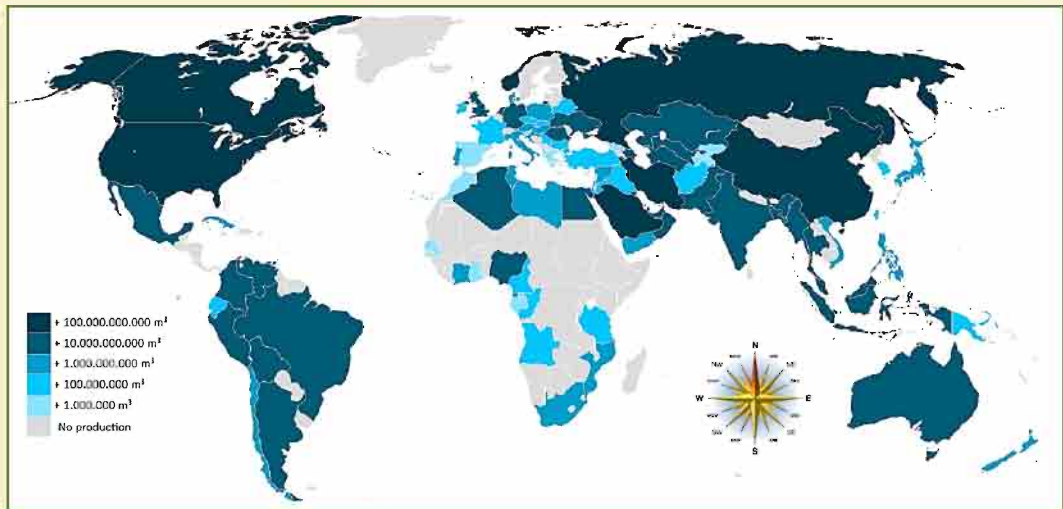


Figure 82. Global natural gas production



Figure 83. Williams natural gas processing plant, La Pata County, Colorado, USA.



Case study 9

Consumption of Global non-renewable energy resources

Tackle the following investigative question in pairs:

- What will be the outcome of overexploitation of global non-renewable energy resources



Exercise 5

Answer the following questions:

1. Differentiate between renewable energy resources and non-renewable energy resources.
2. What are the impacts of energy resources to humans?
3. Discuss why non-renewable energy resources are greatly consumed in comparison to renewable energy resources. . How do you think this can be changed?

Global energy consumption

Energy demand and consumption in the world

Due to globalization and rapid industrialization, the consumption of energy resources has risen as time goes. This is because of the demand by energy consumers such as industries, major towns, hospitals among others.

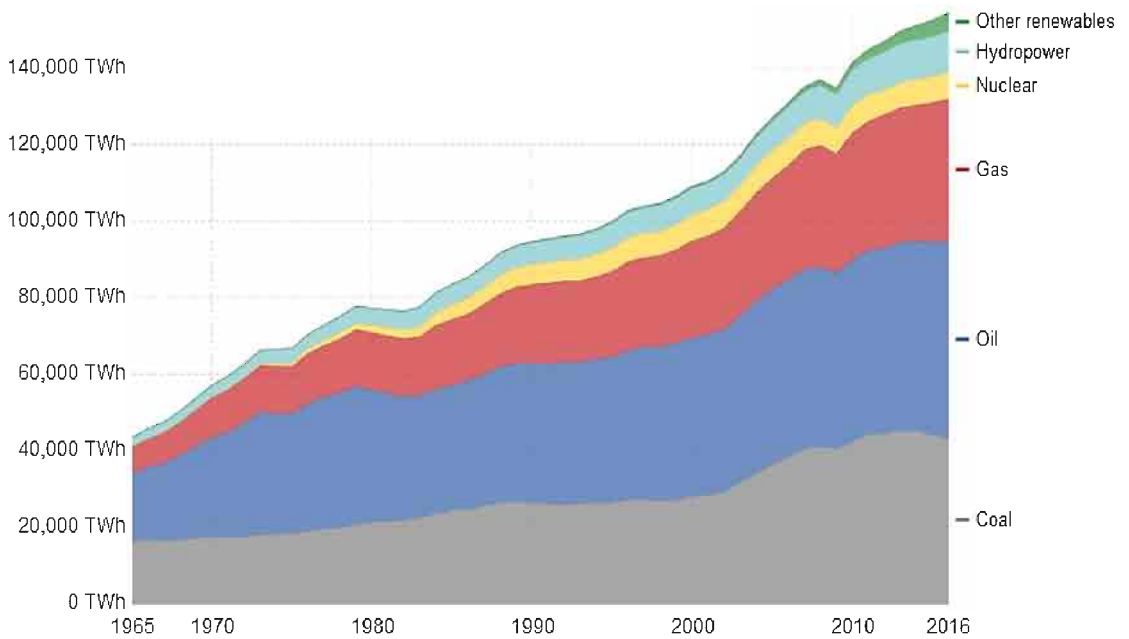


Figure 84. Global energy consumption in terms of energy types

High income countries have gained some interests in the natural resources found in the African and Middle East regions such as coal, oil, and natural gas among others. However, the increase in the demand and consumption of energy poses a threat to the environment since most nations have been constantly using **non-renewable energy resources** which has raised conflicts in many nations.

As countries disagree through wars and differences, the prices of non-renewable energies such as oil are fluctuating. The burning of fossil fuels continues to rise producing high levels of carbon dioxide (CO₂) which is a major cause of global warming.

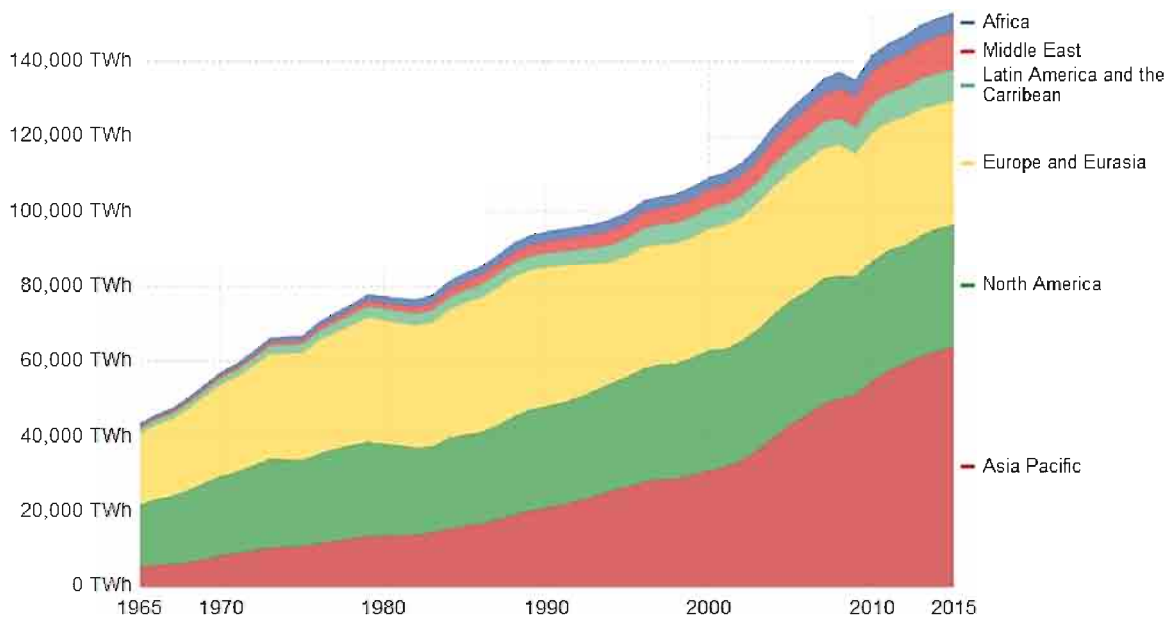






Figure 85. Energy production by region



Case study 10

Global energy supply, demand and consumption

Tackle the following investigative question in groups. (Use any relevant reference material as instructed by the teacher.)

-  From the graphs provided (**refer to pages 87 and 88**), what might be the world's next energy supply in the next decade?
-  Discuss how mining non-renewable energy resources such as oil and coal causes damage to the environment.
-  How has non-renewable resources caused conflicts? Explain.
-  What are South Sudan's major energy resources? How can they be developed sustainably?

Understanding the formation, composition and texture of rocks as compared to soils



Field Observation 1

The composition and texture of rocks and soil

In pairs observe different types of soil and rocks using a **magnifying glass**. Note down the observation on the table on the next page. Describe the different type of soil and rock in many ways possible including how it feels.

Run a **magnet** through the different types of soil you have observed and see what happens.



Figure 86. Observing a rock using a magnifying glass

ITEM	PARAMETER OF OBSERVATION	DESCRIPTION (Write down what you have observed)
<p>Rocks</p> 	<p>Texture</p> <p>How does the rock observed feel when touched?</p>	
	<p>Composition</p> <p>The description of the rock (How does it look like?)</p>	
	<p>Magnetism</p> <p>What happens when a magnet is place over the rock?</p>	
<p>Soils</p> 	<p>Texture</p> <p>How does the soil observed feel when touched?</p>	
	<p>Composition</p> <p>The description of the soil (How does it look like?)</p>	
	<p>Magnetism</p> <p>What happens when a magnet is place over the soil?</p>	

What are rocks?

A **rock** is a naturally formed, non-living earth material. Rocks are made of collections of mineral grains that are held together in a firm, solid mass. How is a rock different from a mineral? Rocks are made of minerals. The mineral grains in a rock may be so tiny that you can only see them with a microscope, or they may be as big as your fingernail or even your finger.



Figure 87. Rocks appear in different form and texture.

Rocks are identified primarily by the minerals they contain and by their texture. Each type of rock has a distinctive set of minerals. A rock may be made of grains of all one mineral type, such as **quartzite**. Much more commonly, rocks are made of a mixture of different minerals. Texture is a description of the size, shape, and arrangement of mineral grains.

Rocks can be studied in hand samples that can be moved from their original location. Rocks can also be studied in outcrop, exposed rock formations that are attached to the ground, or at the location where they are found.

Rocks are classified into **three major groups according to how they form**. The three major classification of rocks include:

1. Igneous rocks.
2. Sedimentary rocks.
3. Metamorphic rocks.

Types of rocks

Igneous rocks

These are rocks formed through the crystallization of molten magma. There are two major types of igneous rocks:

1. **Intrusive igneous rocks:** these types of igneous rocks are formed when magma cools and hardens **beneath the earth's surface**.
2. **Extrusive igneous rocks:** these types of igneous rocks are formed when magma cools and hardens **on top of the earth's surface**.

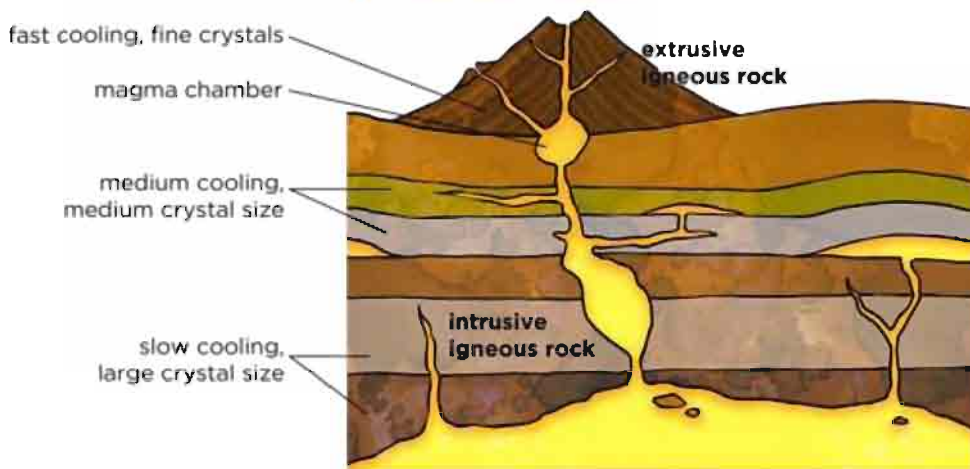


Figure 88. Formation of igneous rocks

Igneous rocks can be classified based on their composition and texture

1. Texture:

- a) **Course-grained texture** is caused by slow cooling of the magma resulting to the formation of larger rock crystals.
- b) **Fine grained texture** is caused by rapid cooling resulting in smaller, interconnected mineral grains and rock crystals.
- c) **Glassy texture** is caused by very rapid cooling of the magma.
- d) **Porphyritic texture** is caused by different rates of cooling resulting in varied sized rocks and minerals.

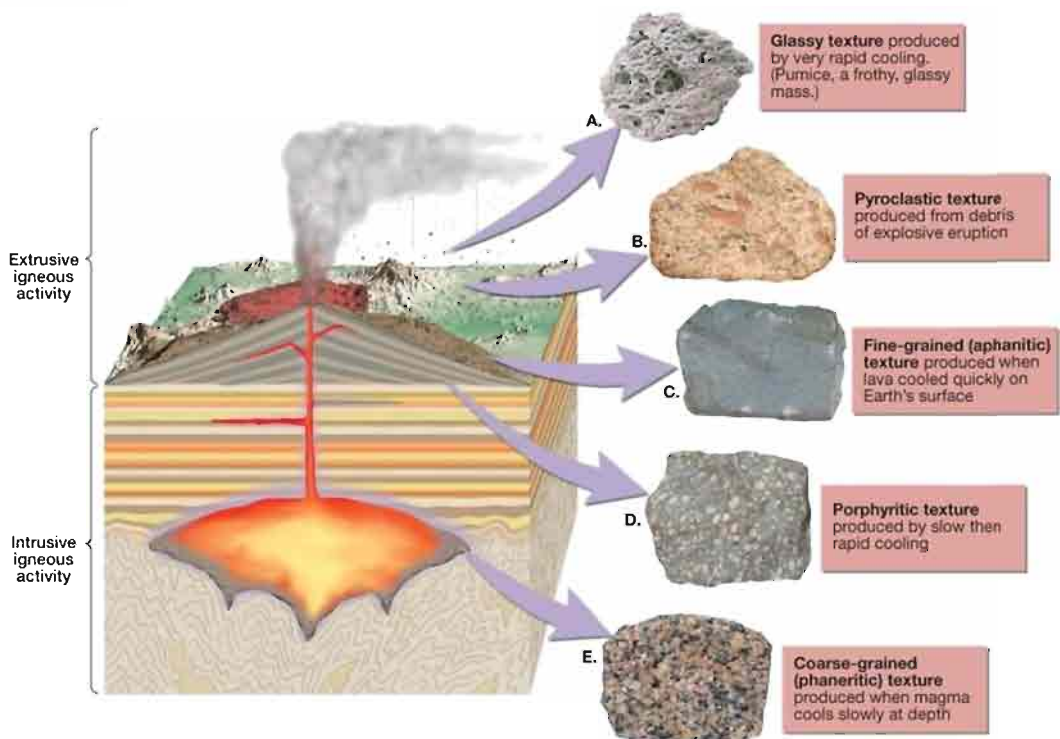


Figure 89. Different igneous rock textures.

2. Composition

- Granitic composition** are evident in igneous rocks made mostly of lightly colored quartz and feldspar.
- Basaltic composition:** this is whereby rocks are made mostly of dark-colored silicate minerals and plagioclase feldspar.
- Andesitic composition** rocks are between granitic light-color igneous rocks and basaltic composition dark-colored igneous rocks
- Ultramafic composition** rocks are made mostly from iron and magnesium-rich minerals.

Progress Check



In groups, compose true or false statement about igneous rocks and present them to the rest of the class. As a class, discuss the viability of the presented statements.

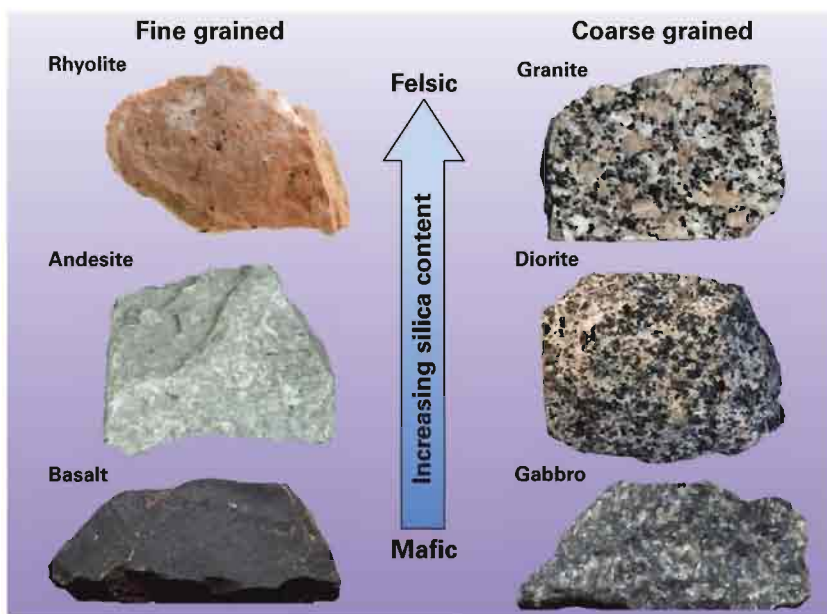


Figure 90. Different types of igneous rocks based on composition and texture.

Sedimentary rocks

Sedimentary rocks are formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding.

There are three distinct groups of sedimentary rocks;

- a) **Common Sedimentary Rocks:** Common sedimentary rocks include [sandstone](#), [limestone](#), and [shale](#). These rocks often start as sediments carried in rivers and deposited in lakes and oceans. When buried, the sediments lose water and become cemented to form rock.
- b) **Clastic Sedimentary Rocks:** Clastic sedimentary rocks are the group of rocks most people think of when they think of sedimentary rocks. Clastic sedimentary rocks are made up of pieces (clasts) of pre-existing rocks. Pieces of rock are loosened by weathering, then transported to some basin or depression where sediment is trapped. If the sediment is buried deeply, it becomes compacted and cemented, forming sedimentary rock. Clastic sedimentary rocks may have particles ranging in size from microscopic clay to huge boulders. Their names are based on their clast or grain size. The smallest grains are called clay, then silt,

then sand. Grains larger than 2 millimeters are called pebbles. Shale is a rock made mostly of clay, siltstone is made up of silt-sized grains, sandstone is made of sand-sized clasts, and conglomerate is made of pebbles surrounded by a matrix of sand or mud.

- c) **Biologic Sedimentary Rocks:** Biologic sedimentary rocks form when large numbers of living things die. Chert is an example for this type of rock, and this is one of the ways limestone can form.

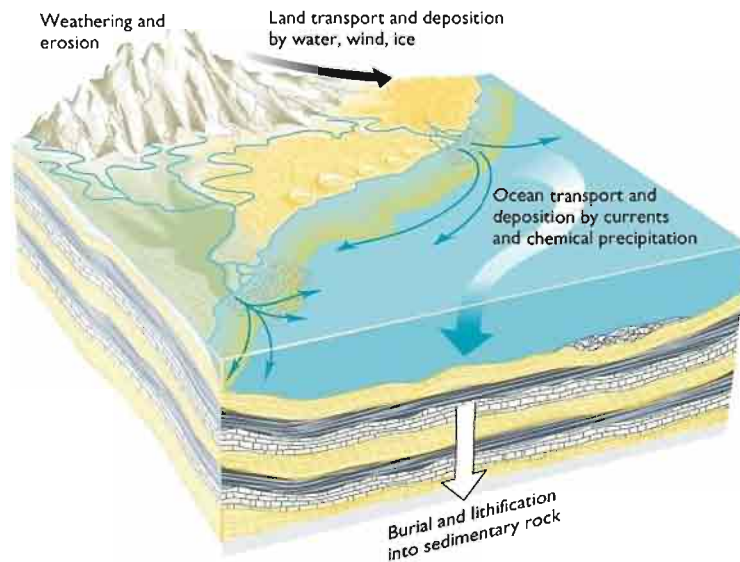
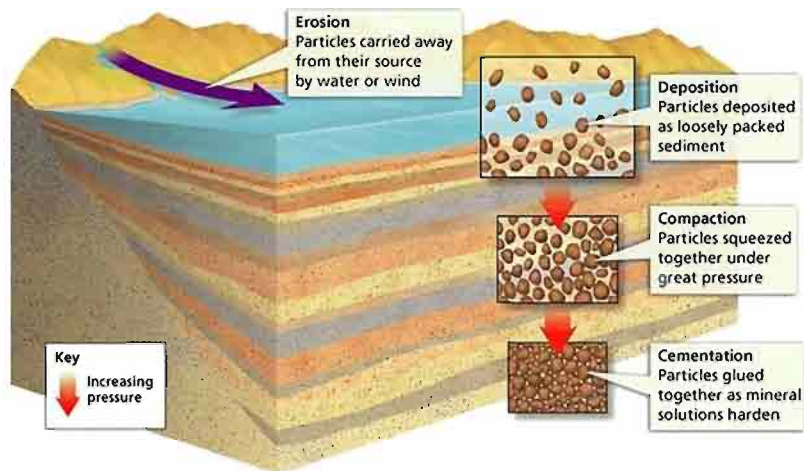


Figure 91. Processes leading to the formation of sedimentary rocks

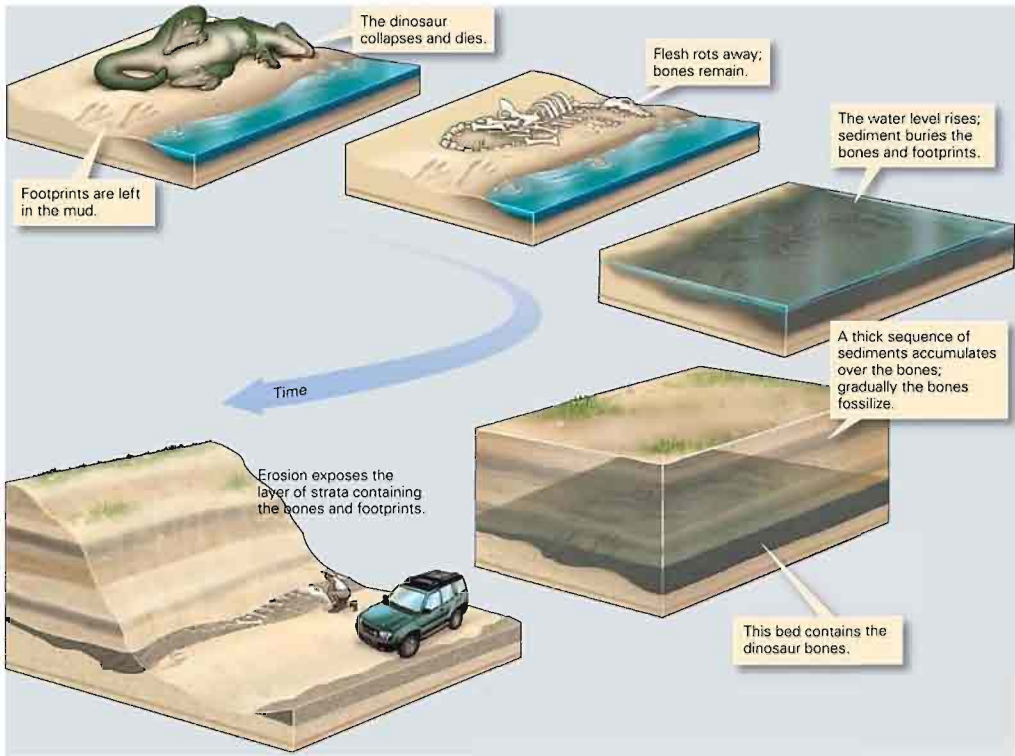


Figure 92. Fossils are examples of biologic sedimentary rocks.



Figure 93. Common sedimentary rocks

Progress Check



In groups: using any local materials, design a simple experiment that could reflect your understanding on how fossils are formed through rock sedimentation.

Metamorphic rocks

Metamorphic rocks are formed from other rocks that are changed because of **heat** or **pressure**. Earth movements can cause rocks to be deeply buried or squeezed. As a result, the rocks are heated and put under great pressure. They do not melt, but the minerals they contain are changed **chemically**, forming metamorphic rocks. Sometimes, metamorphic rocks are formed when rocks are close to some molten magma, and so get heated up.

Note: Remember that metamorphic rocks are not made from melting rock. (Rocks that do melt form igneous rocks instead)

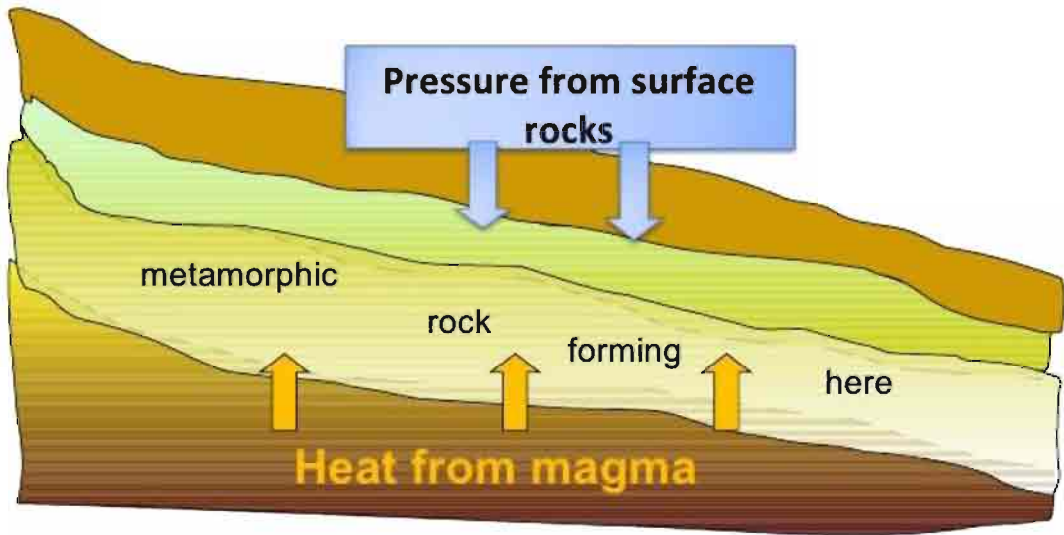


Figure 94. Formation of metamorphic rocks.

Types of metamorphic rocks

When a metamorphic rock is formed under pressure, its crystals become arranged in layers. **Slate**, which is formed from shale, is like this. Slate is useful for making roof tiles because its layers can be split into separate flat sheets.

Marble is another example of a metamorphic rock. It is formed from limestone. Metamorphic rocks sometimes contain fossils if they were formed from a sedimentary rock, but the fossils are usually squashed out of shape.



Gneiss



Slate



Quartzite



Schist



Marble



Phyllite

Figure 95. Examples of metamorphic rocks

Remember

Metamorphic rocks can be formed from any other type of rock - **sedimentary** or **igneous**. Remember these two examples of common metamorphic rocks and where they come from:

- ✓ **Slate** is formed from shale
- ✓ **Marble** is formed from limestone



Comprehensive activity 2

Understanding the different types of rocks

Organize yourself in groups and tackle the following questions

- Which of the following is true about rocks?
 - Rocks are composed of only one mineral
 - Rocks do not contain minerals.
 - Coal is not considered as a rock.
 - Most rocks are a mixture minerals.
- Which of the following is NOT one of the three types of rocks?
 - Igneous.
 - Sedimentary
 - Metamorphic.
 - Minerals.
- Metamorphic rocks form as a result of _____.
- What is the name given to a rock that forms when magma hardens beneath Earth's surface?
 - Intrusive metamorphic rock.
 - Intrusive igneous rock.
 - Extrusive sedimentary rock.
 - Extrusive igneous rock.
- Which of the following is an example of an extrusive rock?
 - Basalt.
 - Coal.
 - Sandstone.
 - Granite.
- Lava that cools so quickly that crystals do not have time to form will lead to an igneous rock with a _____.
 - Porphyritic texture.
 - Coarse-grained texture.
 - Glassy texture.
 - Fine-grained texture.
- Fossils are only found in.
 - Intrusive igneous rocks.
 - Sedimentary rocks.
 - Metamorphic rocks


8. A student obtains a cup of quartz sand from a beach. A saltwater solution is poured into sand and allowed to evaporate. The mineral residue from the saltwater solution cements the sand grains together, forming material similar to _____ (**discuss**)
- a) An extrusive igneous rock.
 - b) An intrusive igneous rock.
 - c) A sedimentary rock.
 - d) A metamorphic rock.
9. Using well labelled diagrams explain how the following rocks are formed:
- a) Sedimentary rocks.
 - b) Igneous rocks.
 - c) Metamorphic rocks.
10. What are fossils? In which of the three categories of rocks do fossils fall?



Case study 11

Usage of rocks

Tackle the following investigative question in groups. (Use any relevant reference material as instructed by the teacher)

 Research on the usage of the following rocks:

- a) Limestone.
- b) Sandstone.
- c) Marble.
- d) Soapstone.
- e) Gravel.
- f) Shale.
- g) Coal.

Transition to igneous rocks

When rocks are pushed deep under the Earth's surface, they may melt into magma. If the conditions no longer exist for the magma to stay in its liquid state, it cools and solidifies into an igneous rock. A rock that cools within the Earth is called **Intrusive** or **plutonic** and cools very slowly, producing a coarse-grained texture such as the rock granite. As a result of **volcanic** activity, magma (which is called lava when it reaches Earth's surface) may cool very rapidly while being on the Earth's surface exposed to the atmosphere and are called **extrusive** or volcanic rocks. These rocks are fine-grained and sometimes cool so rapidly that no crystals can form and result in a natural glass however, the most common fine-grained rock would be known as basalt. Any of the three main types of rocks (igneous, sedimentary, and metamorphic rocks) can melt into magma and cool into igneous rocks.

Transition to metamorphic rocks

Rocks exposed to high temperatures and pressures can be changed physically or chemically to form a different rock, called metamorphic. Regional metamorphism refers to the effects on large masses of rocks over a wide area, typically associated with mountain building events within **orogenic** belts.

These rocks commonly exhibit distinct bands of differing mineralogy and colors, called **foliation**. Another main type of metamorphism is caused when a body of rock comes into contact with an igneous intrusion that heats up this surrounding country rock. This **contact metamorphism** results in a rock that is altered and re-crystallized by the extreme heat of the magma and/or by the addition of fluids from the magma that add chemicals to the surrounding rock (**metasomatism**). Any pre-existing type of rock can be modified by the processes of metamorphism.

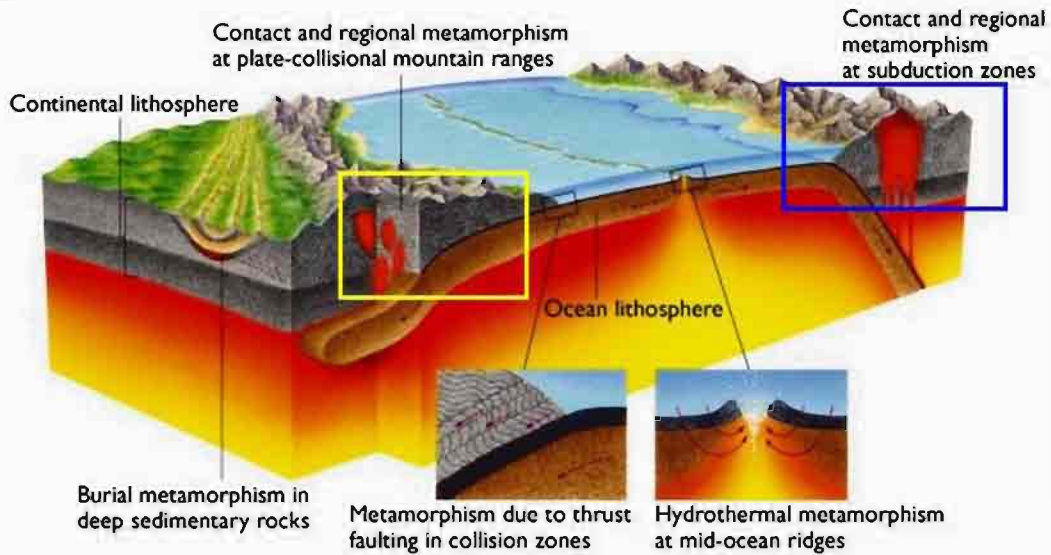


Figure 97. Different types of metamorphism

Transition to sedimentary rocks

Rocks exposed to the atmosphere are variably unstable and subject to the processes of **weathering** and **erosion**. Weathering and erosion break the original rock down into smaller fragments and carry away dissolved material. This fragmented material accumulates and is buried by additional material. While an individual grain of sand is still a member of the class of rock it was formed from, a rock made up of such grains fused together is sedimentary.

Sedimentary rocks can be formed from the **lithification** of these buried smaller fragments (**Clastic sedimentary rocks**), the accumulation and lithification of material generated by living organisms (**Biogenic sedimentary rocks- fossils**), or lithification of chemically precipitated material from a mineral bearing solution due to **evaporation** (precipitate sedimentary rock). Clastic rocks can be formed from fragments broken apart from larger rocks of any type, due to processes such as **erosion** or from organic material, like plant remains. Biogenic and precipitate rocks form from the deposition of minerals from chemicals dissolved from all other rock types.

Progress Check



In groups: design a flow chart representing the major transitions of the rock cycle

Weathering of rocks

Rocks gradually wear away. This process is called **weathering**. There are three types of weathering:

1. Physical weathering.
2. Chemical weathering.
3. Biological weathering.

Physical/ mechanical weathering

Physical weathering is caused by physical changes such as changes in temperature, freezing and thawing, and the effects of wind, rain and waves.

Temperature changes

When a rock gets hot it expands a little, and when a rock gets cold it contracts a little. If a rock is heated and cooled many times, cracks form and pieces of rock fall away. This type of physical weathering happens a lot in deserts, because it is very hot during the day but very cold at night.

Wind, rain and waves

Wind, rain and waves can all cause weathering. The wind can blow tiny grains of sand against a rock. These wear the rock away and weather it. Rain and waves can also wear away rock over long periods of time.

The Freeze-thaw process

Water expands slightly when it freezes into ice. This is why water pipes sometimes burst in the winter. If water gets into a crack in a rock and then freezes, it expands and pushes the crack further apart. When the ice melts later, water can get further into the crack. When the rock freezes again, it expands and makes the crack even bigger. This process of freezing and thawing can continue until the crack becomes so big that a piece of rock falls off.

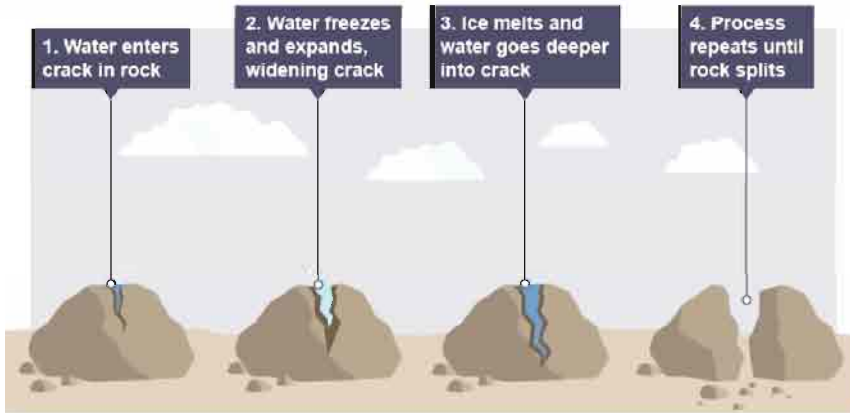


Figure 98. Freeze thaw weathering processes

Biological weathering

Animals and plants can wear away rocks. This is called **biological** weathering. For example, burrowing animals such as rabbits can burrow into a crack in a rock, making it bigger and splitting the rock. You may have seen weeds growing through cracks in the pavement. If you have gone for a walk in the countryside, you may even have seen bushes or trees growing from cracks in rocks or disused buildings. This is because **plant roots** can grow in cracks. As they grow bigger, the roots push open the cracks and make them wider and deeper. Eventually pieces of rock may fall away. People can even cause biological weathering just by walking. Over time, paths in the countryside become damaged because of all the boots and shoes wearing them away.

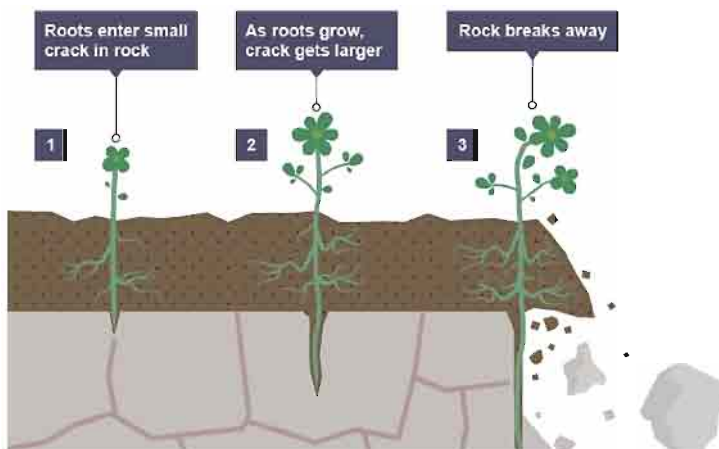


Figure 99. Biological weathering

Chemical weathering

The weathering of rocks by chemicals is called chemical weathering. Rainwater is naturally slightly acidic because **carbon dioxide** from the air dissolves in it. Minerals in rocks may react with the rainwater, causing the rock to be weathered. Some types of rock are easily weathered by chemicals. For example, **limestone** and **chalk** are made of a mineral called calcium carbonate. When acidic rainwater falls on limestone or chalk, a chemical reaction happens. New soluble substances are formed in the reaction. These are washed away and the rock is weathered.

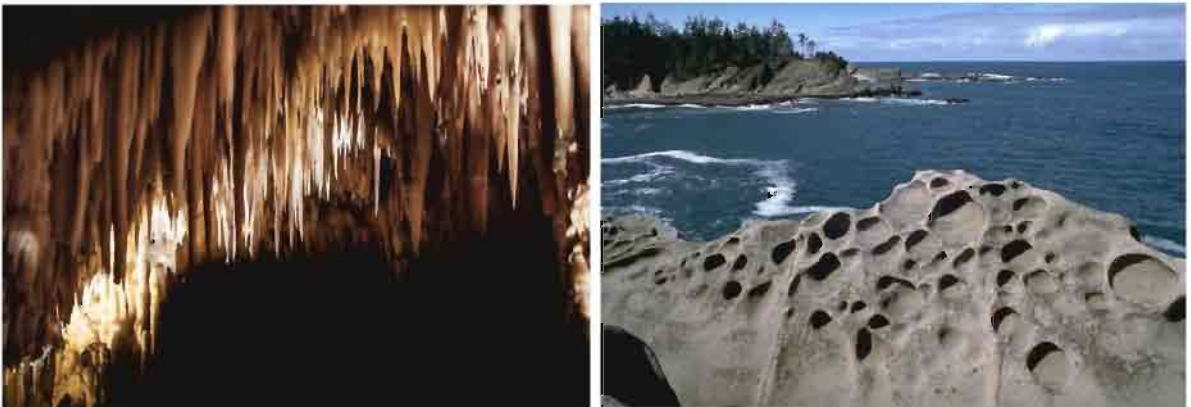


Figure 100. (Left) A chemically weathered limestone cave roof in France and (right) honeycomb-like weathering from dissolution of cement in sandstone, Oregon, USA

Chemical weathering can hollow out caves form and make cliffs fall away. Some types of rock are **not** easily weathered by chemicals. For example, **granite** and **gabbro** are hard rocks that are weathered only slowly. Still some of their minerals do react with the acids in rainwater to form new, weaker substances that crumble and fall away.

Chemical weathering through acid rain

When fossil fuels such as coal, oil and natural gas are burned, **carbon dioxide** and **Sulphur dioxide** escape into the air. These dissolve in the water in the clouds and make the rainwater more acidic than normal. When this happens, we call the rain '**acid rain**'. Acid rain makes chemical weathering happen more quickly. Buildings and statues made from rock are damaged as a result. This is worse when the rock is limestone rather than granite. Acid rain also kills trees and fish.

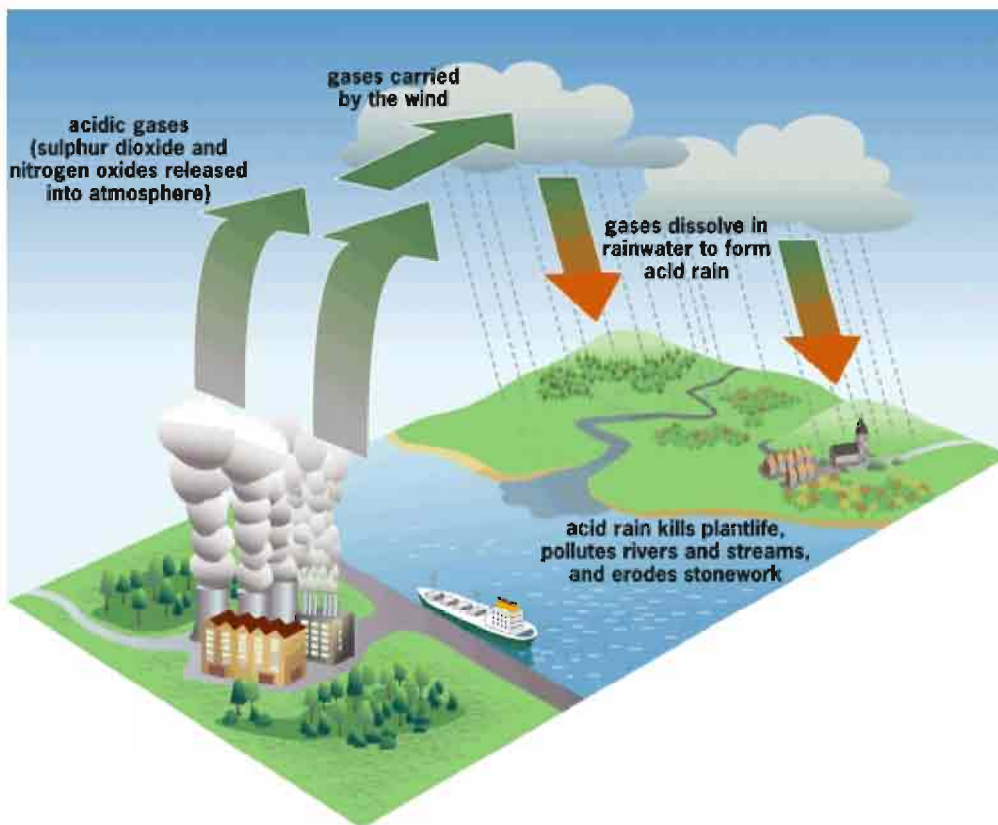


Figure 101. (Top) the formation of acid rain due to industrial activities and (bottom), rocks weathered by acid rain in Kunming Stone forest, China.

Chemical weathering by erosion and transportation

Erosion is the movement of the broken pieces away from the site of weathering. Erosion happens when these pieces of rock fall away down the cliff. On the other hand, rivers and streams can move pieces of rock. This is called **transport**. Fast flowing rivers can transport large rocks, but slow moving rivers can only transport tiny pieces of rock. As the pieces of rock are carried along by the water, they bash against each other and the river bed. They gradually wear away because of this. They become smaller and more rounded.

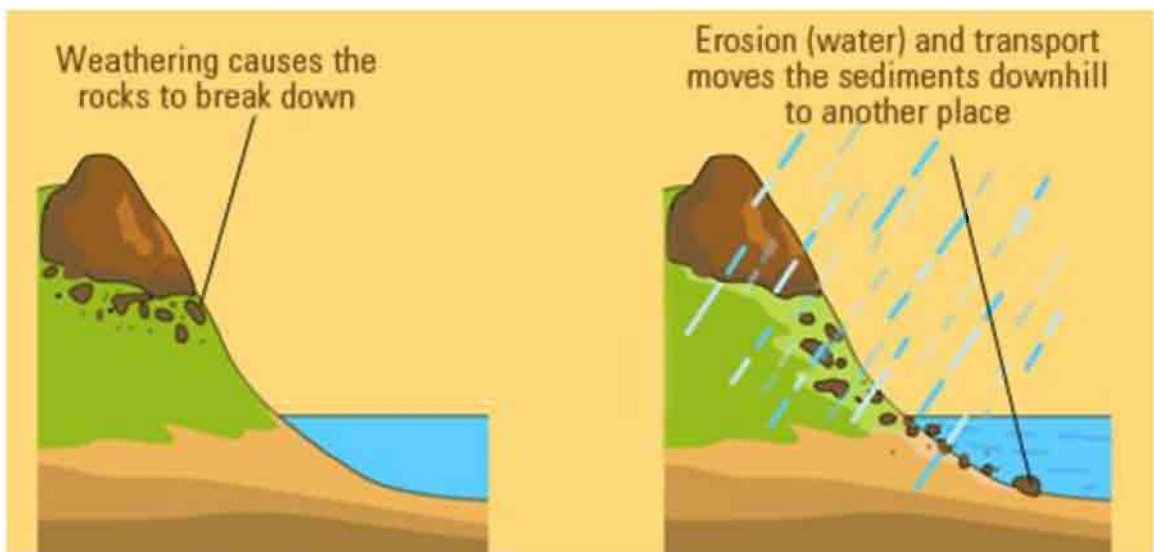


Figure 102. Chemical weathering by erosion and transportation.



Exercise 6

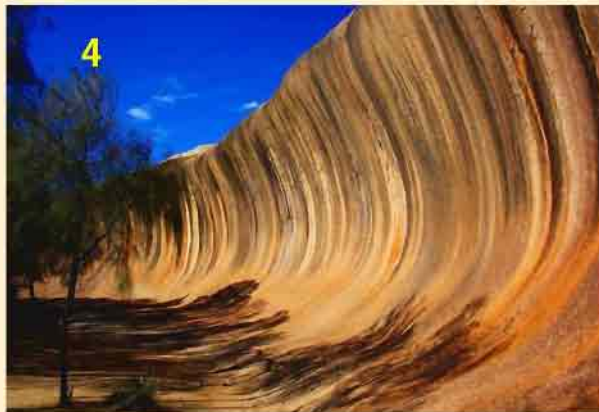
Answer the following questions:

1. Prepare a table that describes the similarity and differences between the following process:
 - a) Physical/ mechanical weathering.
 - b) The freeze- thaw process.
 - c) Biological weathering.
 - d) Chemical weathering.

Progress Check



In groups: Which type of rock weathering do the photographs provided represent?



Unit 6

MINERALS AND MINING

Global production of minerals

What are minerals?

Minerals are defined as solid, inorganic, naturally occurring substances with a definite chemical formula and general structure. Almost all chemical elements in the Earth's crust are associated with at least one mineral. They vary in color, hardness, density, crystal form, crystal size, transparency, composition, location, and abundance.

Different mining processes

Gold mining

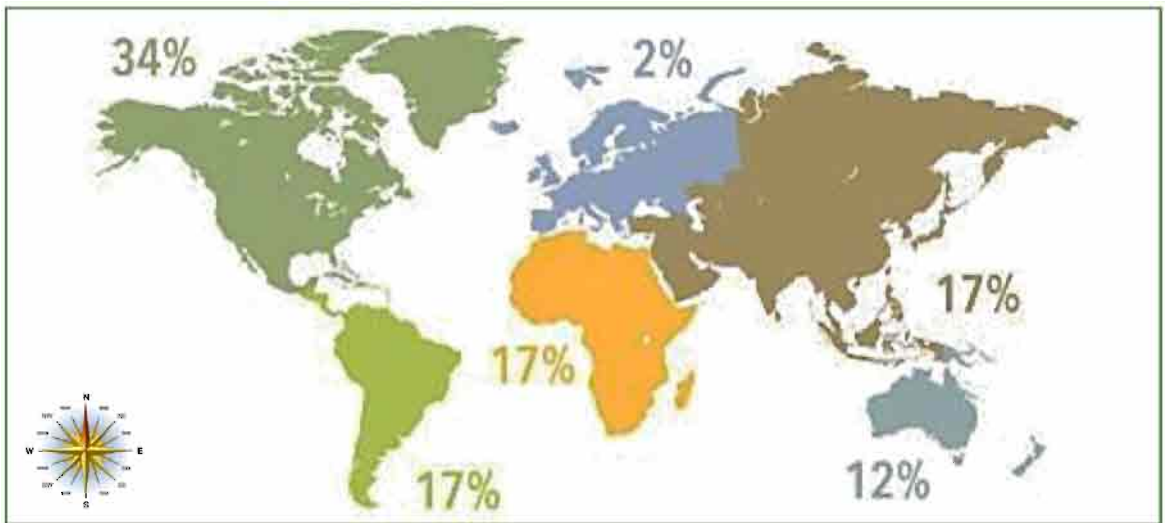


Figure 103. Percentage production of gold (total oz.) by region. 2016.

China is currently the world's largest gold producer. Recently, China's gold mining industry has received increased foreign and domestic investment, and project numbers have increased as more discoveries have been found.

Other top gold mining countries include [Australia](#), [Russia](#) and [South Africa](#). Gold is mined using three methods:

1. Surface mining
2. Open cast mining.
3. Underground excavation.

Surface Gold Mining

Placer mining

Placer mining is the technique by which gold that has accumulated in a [placer deposit](#) is extracted. Placer deposits are composed of relatively loose material that makes tunneling difficult, and so most means of extracting it involve the use of water or dredging.

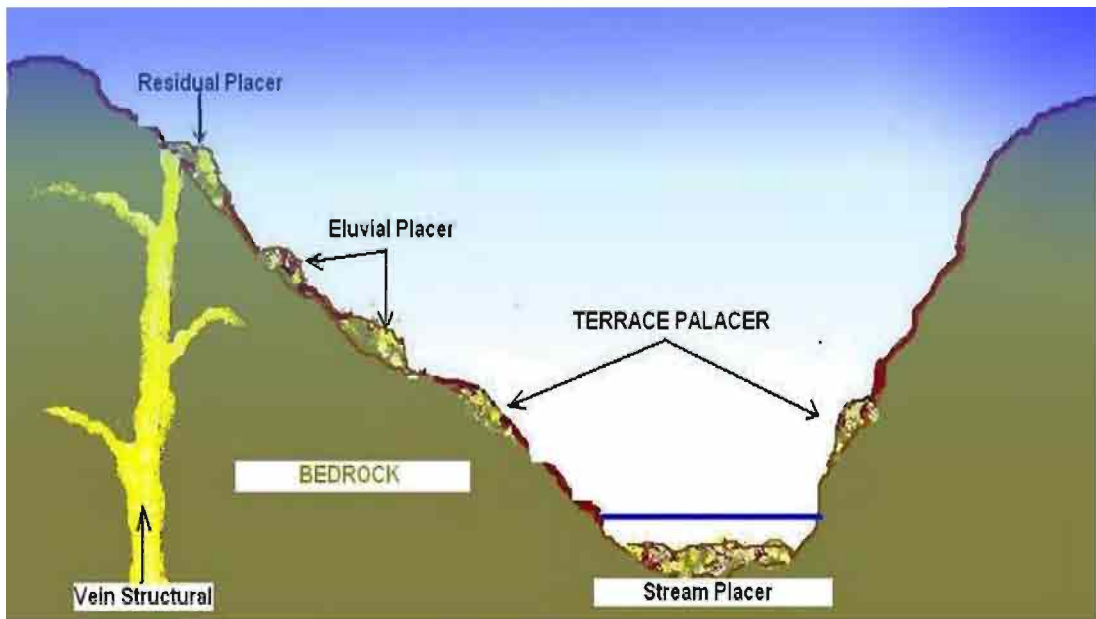


Figure 104. Different types of placer deposits

Panning

Panning is a manual technique of separating gold from other materials. Wide and shallow pans are filled with sand and gravel that may contain gold. The pan is immersed in water and shaken, sorting the gold from the gravel and other material.

As gold is much denser than rock, it quickly settles to the bottom of the pan. The panning material is usually removed from stream beds where the density of gold allows it to concentrate.

Gold panning is the easiest and fastest technique for searching for gold, but is not commercially practical for extracting gold from large deposits, except where labor costs are very low or gold traces are large.

Panning is often promoted as a tourist attraction activity on former gold fields. Before large production methods are used, a new source must be identified and panning is useful to identify placer gold deposits to be evaluated for commercial practicality.



Figure 105. Gold panning

Sluicing

Using a sluice box to extract gold from placer deposits has long been a very common practice in prospecting and small-scale mining. A sluice box is essentially a man-made channel with riffles set in the bottom. The riffles are designed to filter gold out of suspension. The box is placed in the stream to channel water flow. Gold-bearing material is placed at the top of the box. The material is carried by the water current through the box where gold and other dense material settles out behind the riffles. Less dense material flows out of the box as tailings.

Larger commercial placer mining operations hire screening plants, or trommels, to take away the larger alluvial materials such as boulders and gravel, before concentrating the remainder in a sluice box or jig plant. These operations typically include diesel powered, earth moving equipment, including excavators, bulldozers, wheel loaders, and rock trucks.

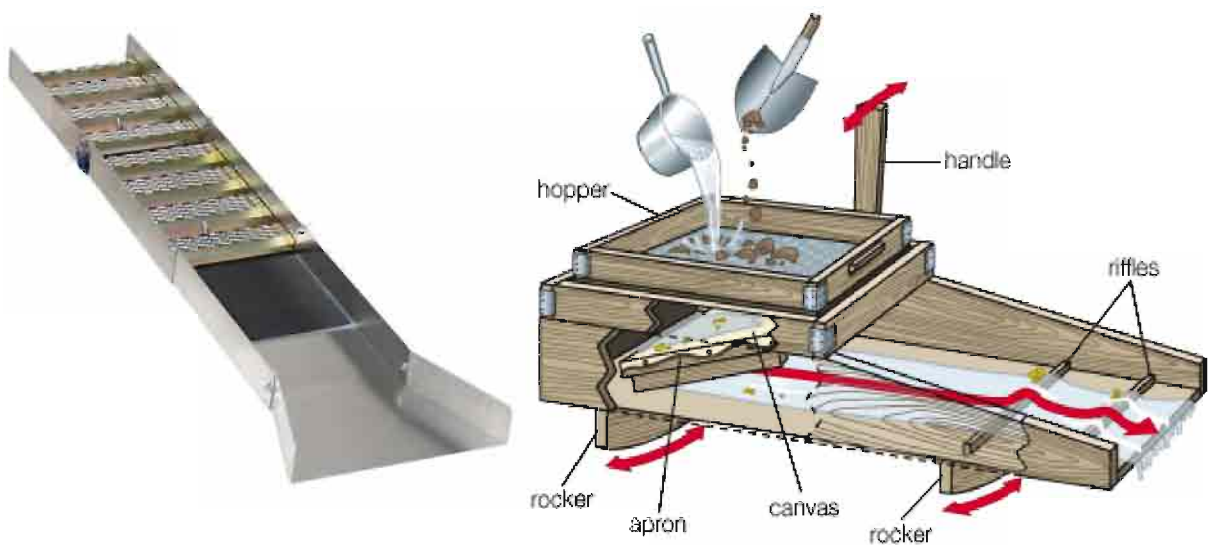


Figure 106. Left, a sluice box and left, a picture showing how a sluice box works

Dredging

Although this method has largely been replaced by modern methods, some dredging is done by small-scale miners using suction dredges. These are small machines that float on the water and are usually operated by one or two people. A suction dredge consists of a sluice box supported by pontoons, attached to a suction hose which is controlled by a miner working beneath the water.

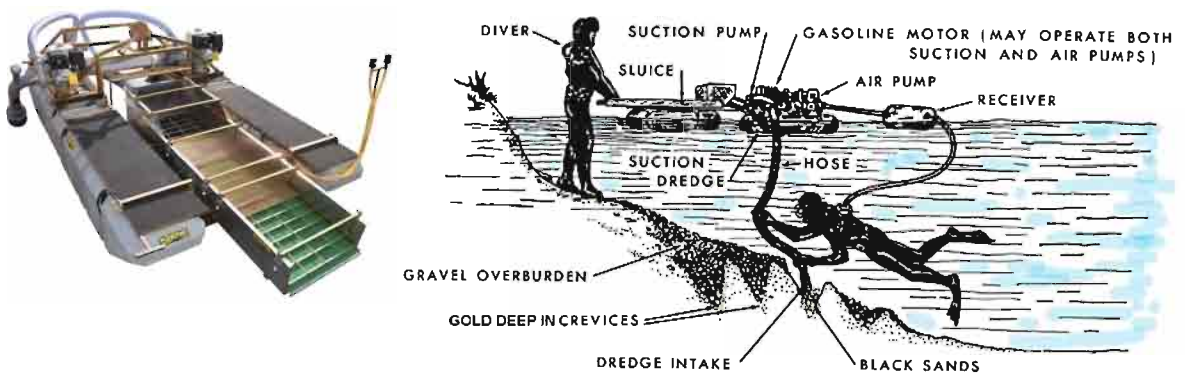


Figure 107. Small scale gold dredging

Some large suction dredges are used in commercial production throughout the world. Small suction dredges are much more efficient at extracting smaller gold than the old models. This has improved the chances of finding gold. Smaller dredges with suction tubes are used to sample areas behind boulders and along potential pay streaks, until "colour" (gold) appears.

Other larger scale dredging operations take place on exposed river gravel bars at seasonal low water. These operations use a land based excavator to feed a gravel screening plant and sluice box floating in a temporary pond. The pond is excavated in the gravel bar and filled from the natural water table. "Pay" gravel is excavated from the front face of the pond and processed through the floating plant, with the gold trapped in the onboard sluice box and tailings stacked behind the plant, steadily filling in the back of the pond as the operation moves forward. This type of gold mining is characterized by its low cost, as each rock is moved only once. It also has low environmental impact, as no stripping of vegetation or overburden is necessary, and all process water is fully recycled.



Figure 108. Large scale Gold dredger

Open cast and underground excavation

Open cast mining is done when the ore body is relatively shallow up to a depth of 400m. The rock is removed layer by layer from the surface of the earth. This is **less costly** and **safer** than an underground mine as it does not require deep level excavation.

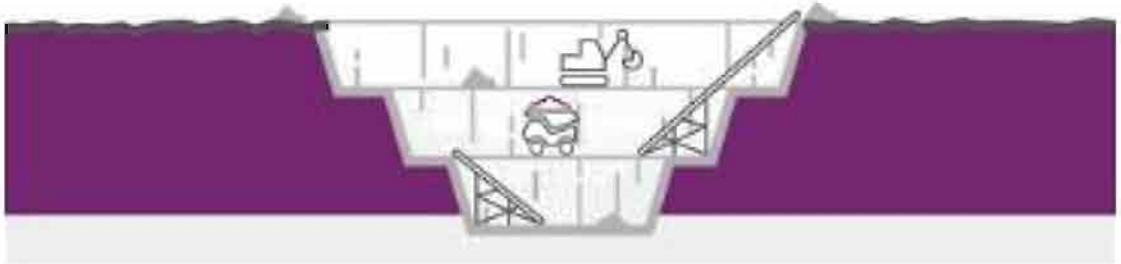


Figure 109. Open cast mining.

If surface ore bodies are exhausted or if the ore body extends deep into the earth, mining goes **underground**. A complex network of **tunnels** and **shafts** are built to access and transport the ore from deep underground to the surface for **purification**.

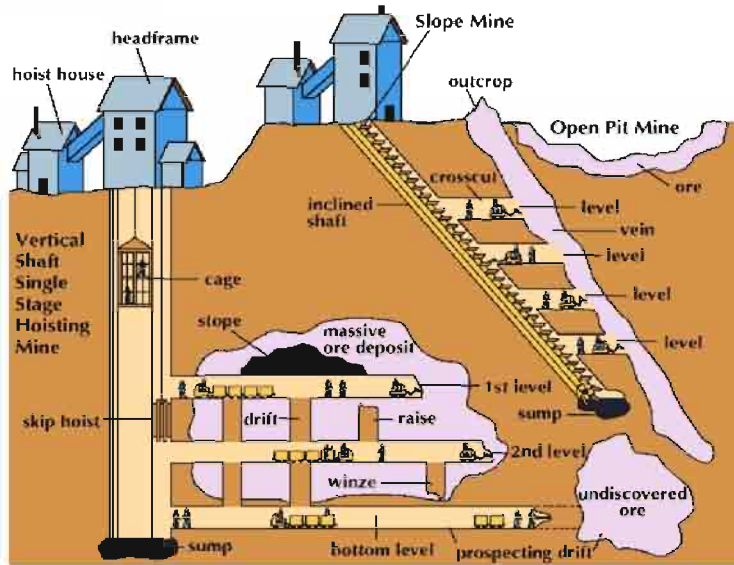


Figure 110. Underground tunnels and shafts

Progress Check



What are the key elements of gold mining? Discuss.

The uses of Gold

Gold is extremely malleable, conducts electricity, doesn't tarnish, alloys well with other metals and is easy to work into wires or sheets. Not to mention, gold is remarkable in its natural brilliant luster and glossy shine. Because of these unique properties, gold makes its way into almost every sphere of modern life in some way, shape or form.

Here are some of the uses of gold:

Jewelry

About 78% of gold consumed each year is made into jewelry. Jewelry is the most common way gold reaches consumers, and has been a primary use for the metal in various cultures. Because of its beautiful and durable properties, gold jewelry is used and an adornment. In India, adorning the body with gold is a way to attract wealth and blessings.



Figure 111. Gold jewelry

Electronic and computers

Gold is a highly efficient conductor that is able to carry tiny electrical charges, and because of this property a small amount is found in almost all electronic devices, including cell phones, televisions, GPS units and more. Because gold is such an efficient conductor of electrical charges, it is also often found in desktop and laptop computers to transfer information quickly



Figure 112. Gold in electronic chips and cables.

Dentistry and Medicine

Gold makes for the best fillings, crowns, bridges and orthodontic appliances because the metal is chemically inert, easy to insert and no allergenic. Gold has been used in dentistry since 700 B.C. and will probably continue to be the best option for replacing broken or missing teeth. In the medical field, small amounts of gold isotopes are used in certain radiation treatments and diagnosis.



Figure 113. Gold in dentistry and medicine.

Medals and awards

As a highly esteemed precious metal, gold makes a natural appearance in crowns, awards and religious statues. Because of its unparalleled beautiful qualities and rarity, gold is one of the highest status symbols. In everything from Academy Awards to Olympic medals, gold is recognized for its admirable qualities and it holds a permanent place of value in humanity's eyes.



Figure 114. Gold medals and trophies

Finances and investing

Because gold is so rare and highly valued, this precious metal makes a natural currency, and has for at least 6,000 years. Gold value has been on the rise in the stock market. In an uncertain economy, gold has emerged as a possible financial staple. One of the most common ways to hold or invest in gold is in gold coins, gold bars, and also gold bullion.



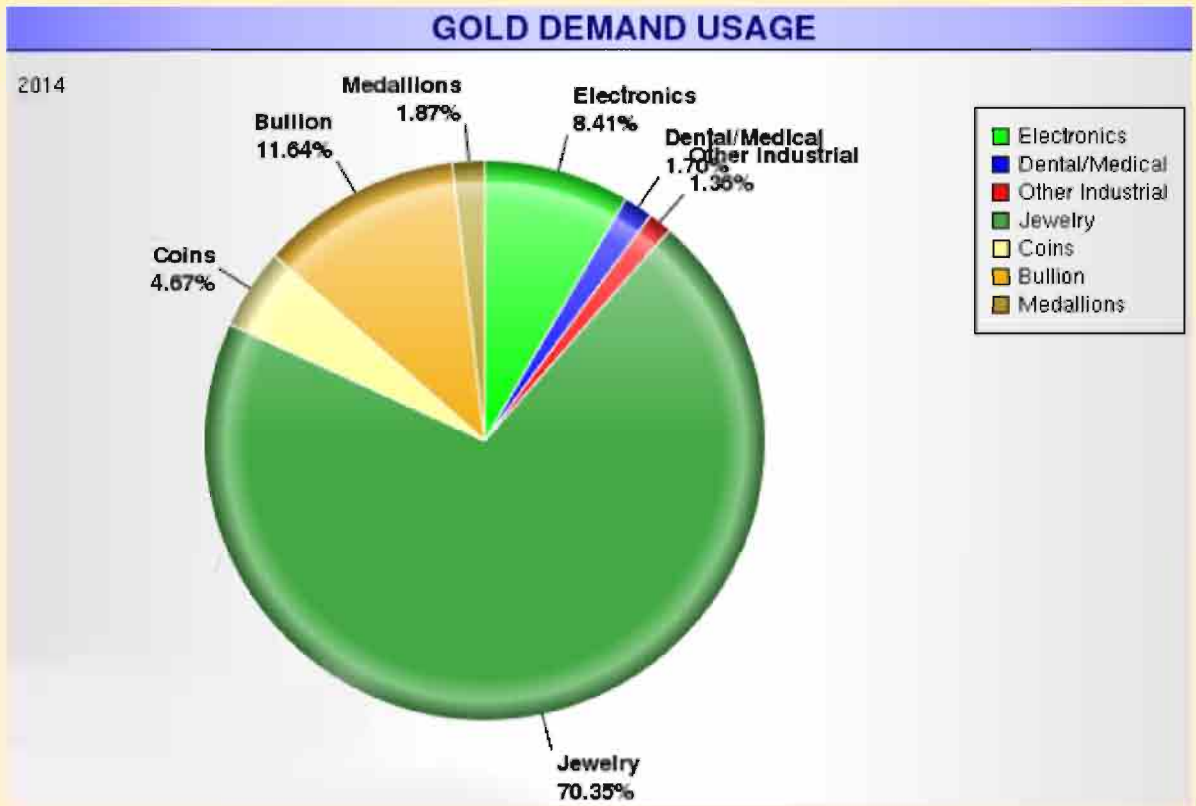
Figure 115. Gold bars and coins

Aerospace

In the aerospace industry where reliable and effective technologies are key to survival, gold plays an essential role. Gold is used to lubricate mechanical parts, conduct electricity and coat the insides of space vehicles to protect people inside from infrared radiation and heat.



Look at the graphical information presented below:



1. What do you believe is the most and least important usage of gold?
2. How might this information change according to your locality?

Diamond mining

There are two major bands of diamond producers around planet Earth, the northern band and the southern band. A **third center band** also has diamonds but of lower quantity and value.

The **Northern band** includes Russia and Canada, two of the leading diamond-producing countries. The **Southern band** includes Southern African states such as Botswana, South Africa and Namibia, as well as Australia. The **center band** includes the Ivory Coast and Sierra Leone in Africa, and Venezuela and Brazil in South America.

The top five producing countries by volume of production are **Russia, Botswana, the Democratic Republic of Congo (DRC), Australia and Canada.**

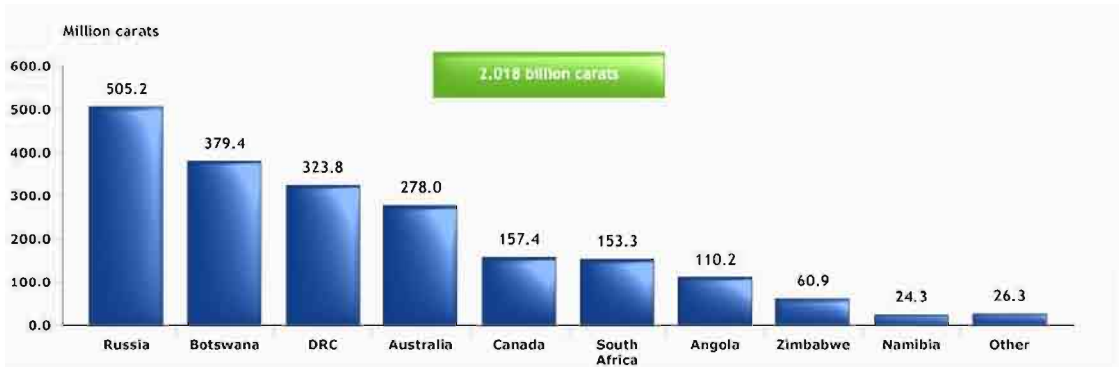


Figure 116. Global production of diamond (2015)

Different methods of diamond mining

Diamond pipe mining

Before any actual mining even takes place, prospectors need to locate diamond sources first. To hit pay dirt and get to the larger sized rough crystals, geologists follow the trail of secondary diamond sources to determine where the primary sources of pipe deposits are.

Once the pipes are found and the presence of diamonds is proven true and profitable, shanks are inserted into the ground at the ore-bearing pipes and huge amounts of soil are extracted. In order to make mining efficient and effective, the raw rock and soil are typically not examined on-site.

Instead, they are transported to special plants where the ore is processed and the rough diamonds are extracted. Depending on how rich the ore is, a few hundred tons of ore might be sieved just to produce a single carat of gem quality rough diamonds.

Even after extraction, the precious gem is still far from being set in an engagement ring. Rough stones are then sorted into various gem-quality categories and industrial-specific grades. Thereafter, the roughs are sold, cut, polished and commercialized.



Figure 117. Diamond pipe mining (left) and a diamond mine in Angola

Alluvial mining

Another mining method that is frequently used is called alluvial mining. This type of mining is usually performed in areas of secondary deposits like riverbanks, beaches or even off-shore locations.

Alluvial mining involves the building of walls and the diversion of rivers. Once the water is emptied out and prevented from flowing into the area of interest, bulldozers can now be used to exploit the ground of the riverbank.

Usually, kimberlite ore can be found in depths of at least 15 meters. When the diamond-rich depth is reached, the raw material extracted from the ground is then transported to a special screening plant for further processing.

There's another form of alluvial mining called **artisanal mining**. It is simply the same method employed by gold diggers which involves the screening and straining of mud. In artisanal mining, the extraction process takes a longer time as low technology equipment and manual labor is usually involved. Compared to alluvial mining, the post-processing is shorter and a less resource-consuming task as diamonds are identified in situ of the work area.



Figure 118. Artisanal diamond miners in Sierra Leone

Progress Check



Which is the most effective method of diamond mining? Discuss.

Uses of diamond

Diamond is very popularly known for being used as a gem in jewelry but other than this basic use of diamond there are many other uses of this valuable stone. Diamonds are being used in many industries as well for various operations. Along with being used in the industry, diamonds are also used for some basic general uses.



Figure 119. Left, diamond gems and right, jewelry made of diamond

The following are other uses of diamond:

1. **Glass cutting:** Small pieces of diamonds are used for cutting glasses. The small portions of diamonds are also used for drilling the rocks. The hardness of the diamond is the main reason why diamonds are preferred for doing such cutting and drilling activities. You must have also heard that a diamond can cut a diamond and that is true. A small portion of diamond can be used for making a cut in large diamond pieces.



Figure 120. A glass cutting tool with a tip made of diamond

2. **Polishing other stones:** No matter if a diamond is used in the solid form or in the form of dust, diamond holds a number of uses. The dust of the diamond can be used for polishing other diamonds and precious stones. The dust of the diamond gives an enhanced shine in the other stones.
3. **Tungsten Wires:** It may also amaze some of the people that a diamond can also be used in making tungsten wires. The diamond dies are used for the process of making the wires using the lab equipment.



Figure 121. Synthetic tungsten wires coated with diamond

4. **Engrave Stones:** diamonds can be used for engraving stones to various other metals. The various stones that can be engraved are granite, quartz, etc. The workers feel no need for the replacement of engraving bit as the diamond does not break, scratch or damage any of the stones. As a result of the same, the work can be done without any worries or tension.



Figure 122. Stone engraving

5. **Electronic Applications:** Since diamonds possess a high level of thermal conductivity, therefore, diamonds can be used in various electronic applications to prevent the delicate parts from getting damaged from the heat rays of the sun. The diamonds are used as heat sinks in such electronic applications for repelling away the heat of the sun.



Figure 123. A heat sink in computers and other electronic systems



Case study 12

The effects of mining on the environment

Tackle the following investigative question in groups. (Use any relevant reference material as instructed by the teacher)

- 🐜 Mining is good for the economy of a country however, it poses serious damages to the environment. Discuss some of the **damages** caused by mining to the environment near the mines.
- 🐜 What are some of the **dangers** that underground miners face?
- 🐜 Produce a poster showing the positive and negative effects of mining.

Iron mining

China, the largest producer, consumer and importer of iron ore, produced 1.3 billion tonnes (BT) of iron ore in 2012, accounting for about 44% of the world's output. Australia is the world's second iron producer followed by Brazil, India, Russia, Ukraine, South Africa, USA, Kazakhstan and Iran.

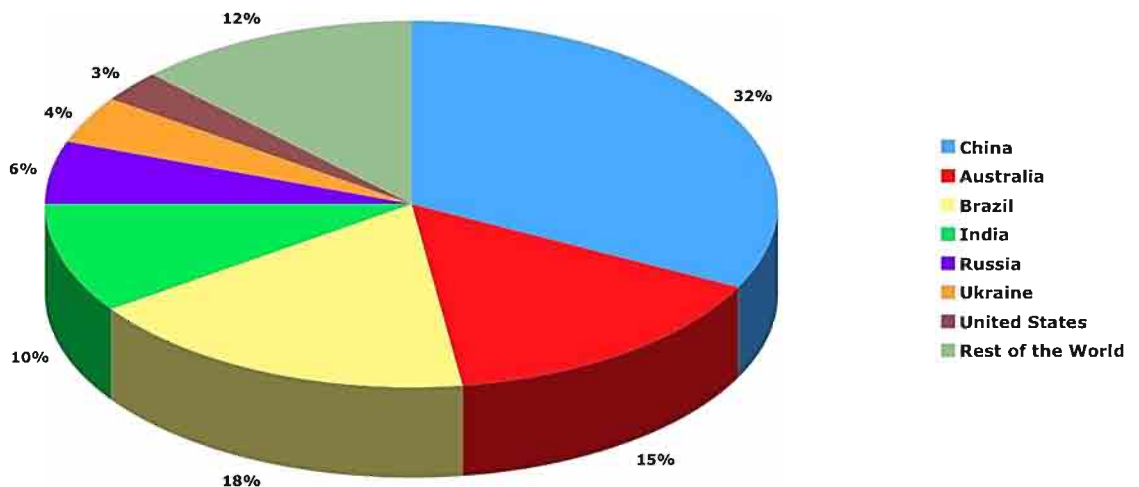


Figure 124. World Iron production (2017)

Different methods of iron mining

Surface mining

Open cast mining is done when the iron ore (taconite rock) is relatively shallow up to a depth of 400m and a width of approximately 1 or 2 km. miners use explosives to blast the taconite rock into chunks small enough to handle. The rock is then removed layer by layer from the surface of the earth. This is **less costly** and **safer** than an underground mine as it does not require deep level excavation.



Figure 125. Left, a miner prepping up an explosive at an iron mine in Australia and right, an explosion in an iron mine.

Underground mining

If surface taconite rocks are exhausted or if the taconite extends deep into the earth, mining goes **underground**. A complex network of **tunnels** and **shafts** are built to access and transport the ore from deep underground to the surface for **purification**.



Figure 126. Mining machines and vehicles in Kiruna underground iron mine, Sweden.

Iron processing

Trucks take the extracted iron ore to processing plants where the ore is crushed to smaller pieces by rock crushing machines. The rock is mixed with water and ground to fine particles with rotating mills.



Figure 127. Trucks loading and transporting iron ore to iron processing plants.

The iron bearing mineral called **magnetite**, is separated from the non-magnetic non-iron bearing waste rock using **magnetism**. The remaining rock is waste material called **tailings** and is stock piled in large basins or depressions. The magnetite material has now been upgraded to higher iron content (now the size of fine sand) called **iron concentrate**.

Some mines use a process called **floatation** to further separate iron from unwanted materials such as silica by placing the concentrate in a **slurry**. The iron slurry is then separated by large vacuums to draw off the water resulting in a dryer substance with more iron and less water.

The concentrate is rolled with clay inside large rotating cylinders. The cylinders cause the powder to form marble sized balls. The balls are then heated red hot. They become hardened and eventually cool. The finished product is an **iron ore pellet** with **65%** iron and designed to melt efficiently in a **blast furnace**.

The iron pellets are then transported by rail or by ship to steel making plants where they are melted to make steel and iron products.



Figure 128. Iron ore pellets smelted to usable iron.

Progress Check



In groups, produce some true or false statements about iron mining and challenge other class members to verify their validity.

Uses of Iron

Iron metal is strong but also quite cheap. Most automobiles, machine tools, the hulls of large ships, building parts and machine parts are made of iron. **Steel** is made by combining other iron and other metals. **Stainless steel** is used in building parts, cooking pots, pans, cutlery and surgical equipment. It is also used in aircraft and automobiles.





Figure 129. The uses of iron and stainless steel.



Case study 13

Mining in South Sudan

Tackle the following investigative question in groups. (Use any relevant reference material as instructed by the teacher)

-  What are some of the minerals found in south Sudan?
-  How can these minerals be exploited sustainably?



Exercise 7

Answer the following questions:

1. Define minerals.
2. Differentiate between Open cast mining and underground excavation.
3. Describe the following surface mining practices:
 - a) Placer mining.
 - b) Panning.
 - c) Sluicing.
 - d) Dredging.
 - e) Alluvial mining.
4. Differentiate between alluvial mining and diamond pipe mining.
5. How are the following minerals mined?
 - a) Gold.
 - b) Diamond.
 - c) Iron.
6. Explain the various uses of the following minerals:
 - a) Gold.
 - b) Iron.
 - c) Diamond.

Unit 7

REGIONAL STUDIES

The East African Region

Physical Geography

East Africa is a region that begins in Tanzania in the south and extends north through the great grasslands and scrub forest of the savannas of Kenya and Uganda and then across the highlands of Ethiopia, including the Great Rift Valley.

Countries found in the Eastern African region include, Kenya, Tanzania, Uganda, Burundi, Rwanda, Somalia, Ethiopia, Eritrea, Djibouti, Sudan, South Sudan, Comoros and Seychelles.



Figure 130. A map showing the physical features of Eastern Africa region

Water bodies

The world's second-largest lake by surface area is **Lake Victoria**, which borders Uganda, Tanzania, and Kenya. (Lake Superior, on the border between the United States and Canada, is considered the lake with the largest surface area.) Lake Victoria provides fish and fresh water for millions of people in the surrounding region. The **White Nile** starts at Lake Victoria and flows north to the city of Khartoum in Sudan, where it converges with the **Blue Nile** to become the **Nile River**. The source of the Blue Nile is **Lake Tana** in the highlands of Ethiopia.

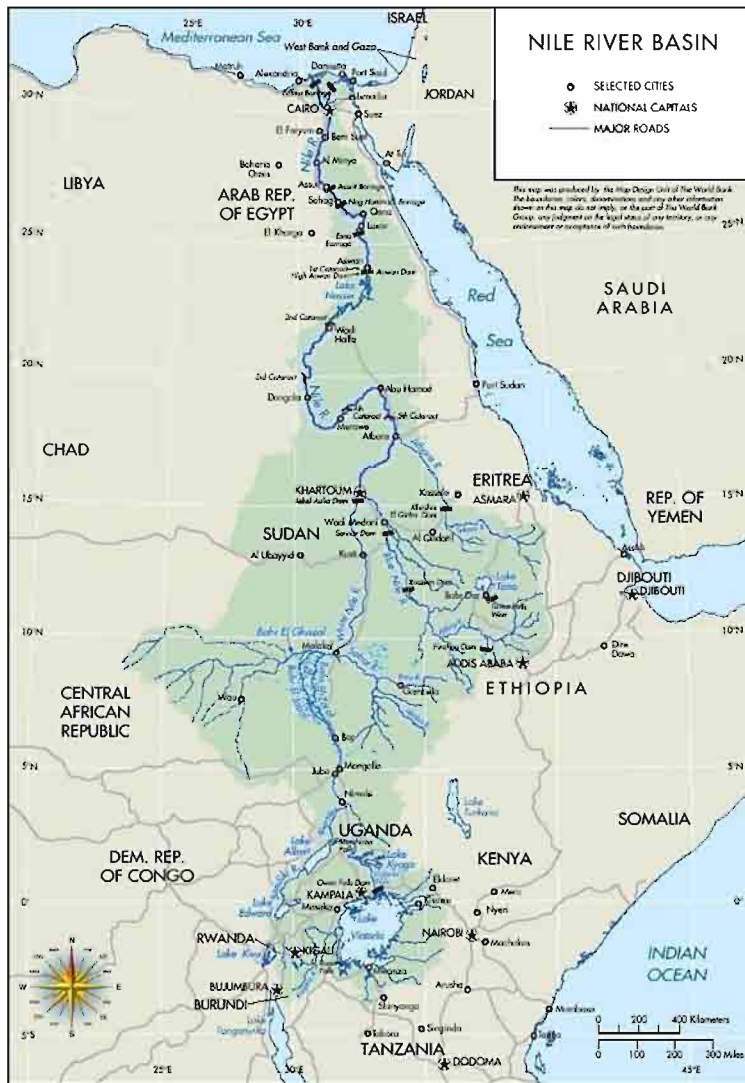


Figure 131. The Nile River and Lake Victoria

Mountains

The highest mountain in Africa, **Mt. Kilimanjaro** (19,340 feet), is located in Tanzania near the border with Kenya. The second highest peak, **Mt. Kenya** (17,058 feet), located just north of the country's capital of Nairobi, near the equator, is the source of Kenya's name. Both mountains are inactive volcanoes and have permanent snow at their peaks. They provide fresh water, which flows down their mountainsides, to the surrounding areas. These mountain act as key tourist attraction to the region.



Figure 132. Top, Mount Kilimanjaro and Bottom, Mount Kenya

Mountain ranges in the Western Highlands of the Congo have a greater effect on climate than these two massive peaks. For example, the Rwenzori Mountains on the Congo–Uganda border have permanent snow and glaciers and reach elevations of more than sixteen thousand feet. These ranges create a rain shadow effect that cuts off moisture for the region from the westerly equatorial winds.



Figure 133. Rwenzori Mountains

The Great Rift Valley

The Great Rift Valley provides evidence of a split in the African Plate, dividing it into two smaller tectonic plates: the Somalian Plate and the Nubian Plate. The Great Rift Valley in East Africa is divided into the **Western Rift** and the **Eastern Rift**. The Western Rift runs along the border with the Congo. A series of deep water lakes run along its valley.

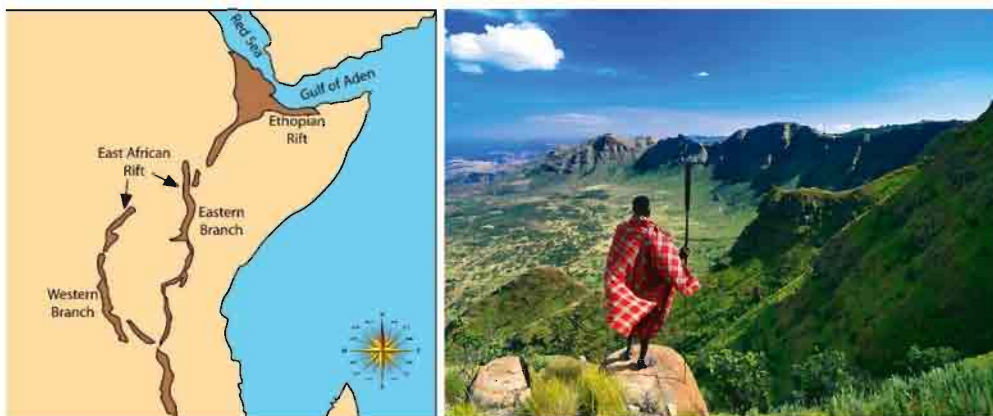


Figure 134. The Great Rift Valley

On the western edge of the Western Rift are the highlands, which have a series of high-elevation mountain ranges, including the **Rwenzori Mountains**, The **Virunga Mountains** on the Congo–Uganda border are home to endangered mountain gorillas. The Western Rift includes a series of deep water lakes, such as Lake Tanganyika, Lake Edward, and Lake Albert. Lake Victoria is located between the Western Rift and the Eastern Rift.



Figure 135. A gorilla feeding at the slopes of Virunga Mountains

The Eastern Rift does not have deep water lakes; rather, it is a wide valley or basin with shallow lakes that do not have outlets. The lakes have higher levels of sodium carbonate and mineral buildup because of a high rate of evaporation. The differences in water composition of the lakes along the Eastern Rift vary from freshwater to extremely alkaline. Alkaline water creates an ideal breeding ground for algae and other species of fish, such as tilapia, which thrive in this environment. Millions of birds feed off the abundant supply of algae and fish. Birds attract other wildlife, which in turn creates a unique set of environmental ecosystems. The eastern edge of the Eastern Rift is home to the inactive volcanic peaks of Mt. Kilimanjaro and Mt. Kenya. A number of other volcanic peaks are present in the Eastern Rift, such as **Oi Doinyo Lengai** is an active volcano found in Kenya.

Progress Check: Creating a fact sheet



Mr. and Mrs. Ford would like to visit East Africa, South Sudan in particular. Unfortunately, they do not have a copy of a map of East Africa or a brochure to guide them in the course of their journey. In groups, design a fact sheet for the East African region that highlights the physical features described in the previous topic. **Make sure you highlight the key words and landmarks.**



Population Distribution & Settlement

Eastern Africa ranks number **1** in Africa among sub regions ranked by Population. The current population of **Eastern Africa** is **427,432,130**. Eastern Africa population is equivalent to **5.59%** of the total world population. The total land area is 6,667,493 Km² (2,574,332 sq. miles). The population density in Eastern Africa is 63 per Km² (164 people per mi²). **26.1 %** of the eastern African population is **urban**. Most of the people in East Africa live in rural areas.



How do you think this compares to other regions in Africa? How do you think the population data about Africa compares to other continents? Can you explain the similarities and differences?

The Economy of the East African Region

The East African Community (The EAC)

East Africa is currently the fastest growing sub-region on the continent. The **East African Community (EAC)** is an intergovernmental organization composed of six countries in the African Great Lakes region in eastern Africa: Burundi, Kenya, Rwanda, South Sudan, Tanzania, and Uganda. South Sudan joined the east African Community in [March 2016](#).

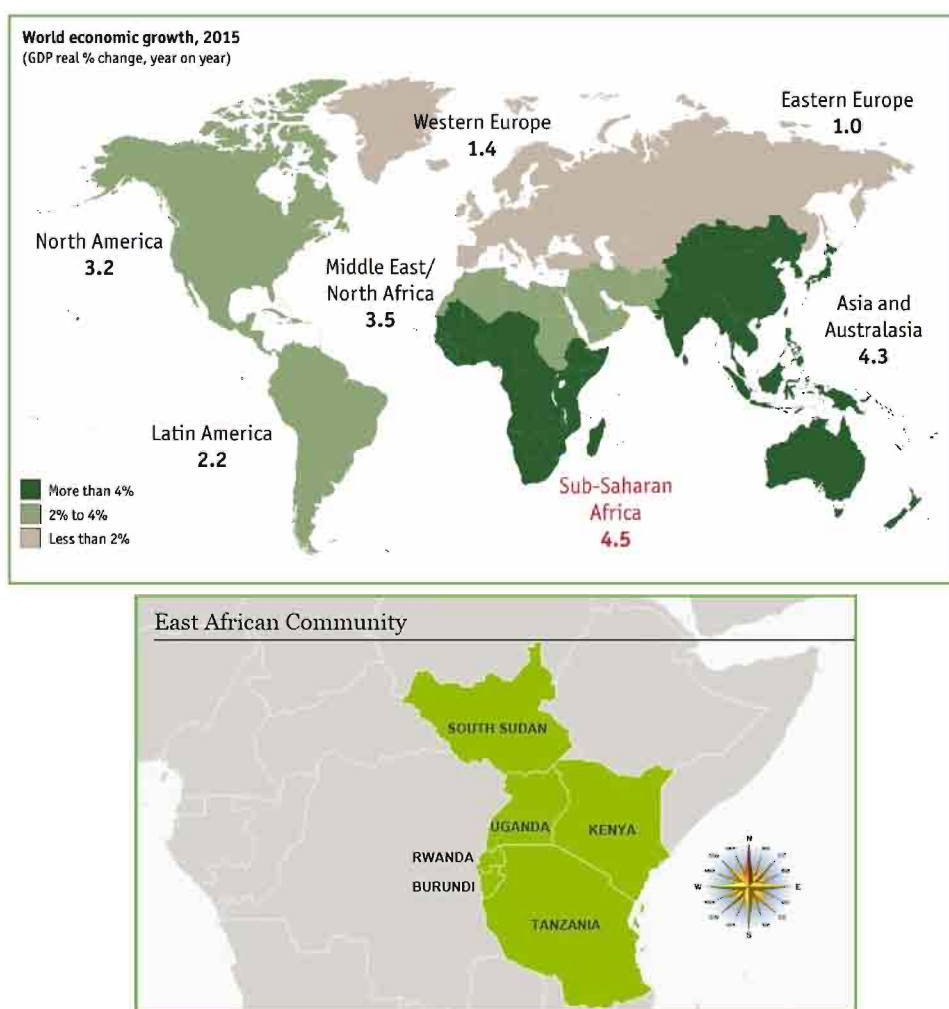


Figure 137. **Top:** Global regional Economic Growth (2015) and **Bottom:** East African Community (EAC) member states.

Countries within the East African community have agreed to establish free trade on goods and services amongst them with **zero duty imposed**. This has enabled landlocked countries such as South Sudan, Uganda, Rwanda and Burundi to trade freely with coastal countries.

To accelerate economic growth and development, EAC Partner States maintain the following freedoms and Rights:

- Free Movement of Goods
- Free Movement of Persons
- Free Movement of Labour / Workers
- Right of Establishment and residence.
- Free Movement of Services
- Free Movement of Capital

Economic Activities in the East African Region

The economy of Africa consists of the trade, industry, fishing and agriculture. Since countries within the regional receive ample rainfall, agriculture is mainly based on subsistence farming. In some cases farmers engage in large scale farming of crops such as wheat, maize, sugarcane, rice, sorghum and millet among others. Maize is East African staple food.



Figure 138. A maize plantation in Kitale, Kenya.

People living around large water bodies such as lakes and rivers practice fishing for a living. **Fresh water fishing** is done in major inland lakes and rivers while **salt water fishing** is done in the coastal areas bordering the Indian Ocean.

There are many industries within the East African region. They include mining industries, manufacturing industries, food processing industries and car assembly industries among others.

The **major economic products** produced in East Africa include **Tea, coffee, oil, salt, diamond** (Tanzania), **horticultural products** and **livestock products** among others.



Comprehensive Activity 3

What is the economic importance of South Sudan to the East African region? Use the map below



Infrastructure and Development

The Standard Gauge Railway (SGR)

Kenya, East Africa's largest economy, is leading infrastructure developments in the region. The **standard gauge railway** (SGR), a new rail track that will stretch from Mombasa to Nairobi, is the most ambitious infrastructure project in the country since independence. The 609km-long line is the first part of the broader Lamu Port-South Sudan-Ethiopia transport corridor. This integrated mega-project will connect countries in the region via oil refineries, **ports** and railway lines.

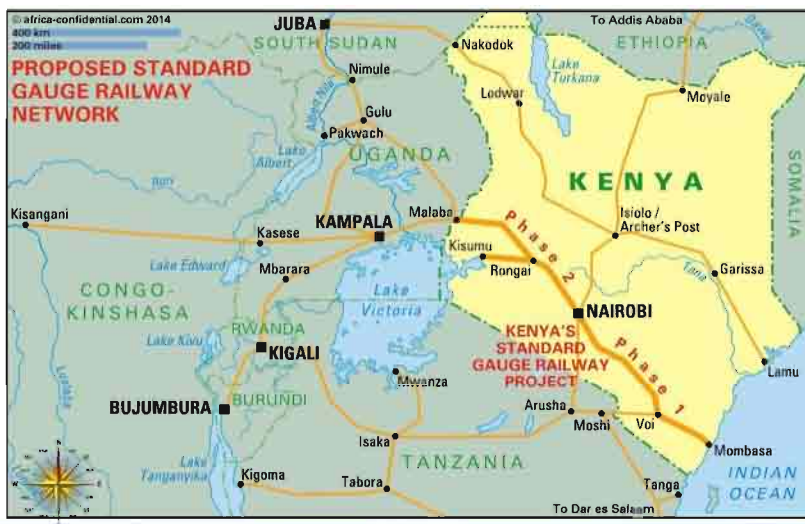


Figure 139. Top, a map of the proposed standard gauge railway and bottom, the completed phase 1 Mombasa-Nairobi Railway line.

The Lamu Port South Sudan, Ethiopia Transport Corridor program (LAPSSET)

The LAPSSET Corridor Program is Eastern Africa's largest and most ambitious infrastructure project bringing together Kenya, Ethiopia and South Sudan. This mega project consists of seven key infrastructure projects starting with:

- A new 32 Berth port at Lamu (Kenya).
- Interregional Highways from Lamu to Isiolo, Isiolo to Juba (South Sudan), Isiolo to Addis Ababa (Ethiopia), and Lamu to Garsen (Kenya), Crude Oil Pipeline from Lamu to Isiolo, Isiolo to Juba.
- Product Oil Pipeline from Lamu to Isiolo, Isiolo to Addis Ababa.
- Interregional Standard Gauge Railway lines from Lamu to Isiolo, Isiolo to Juba, Isiolo to Addis Ababa, and Nairobi to Isiolo.
- 3 International Airports: one each at Lamu, Isiolo, and Lake Turkana.
- 3 Resort Cities: one each at Lamu, Isiolo and Lake Turkana.
- And the multipurpose High Grand Falls Dam along the Tana River.



Figure 140. The proposed Lamu port under construction.



Case study 14

Factors influencing Regional Development

Tackle the following investigative question in groups. (Use any relevant reference material as instructed by the teacher.)

- Describe the factors that speed up development in the East African region?
- Discuss some of the factors that may hinder regional development.



Exercise 8

Answer the following questions:



- Describe the key physical features of the East African region?
- Discuss the major economic features of the East African region?

Other regions in Africa

The West African Region

West Africa, is a region of the western part of the African continent comprising the countries of Benin, Burkina Faso, Cameroon, Cape Verde, Chad, Côte d'Ivoire, Equatorial Guinea, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo. The population of West Africa is estimated at about **362 million**.



Figure 141. The West African region

Religion

Islam is the predominant religion of the West African interior and the far west coast of the continent (70% of West Africans); and was introduced to the region by traders in the 9th century.

Physical Geography

West Africa is remarkable for its geological variety. West Africa is relatively flat and low, which sets it apart from the other major regions of Africa. West Africa has rivers, including the Niger (West Africa's longest river) originating in the Guinea Highlands, where rainfall is heavy. Other major rivers rise from Guinea's Fouta Djallon, including the Gambia and Senegal. The Senegal River drains a major basin (the third largest in West Africa after the Niger Basin and the Lake Chad Basin). West Africa's rivers experience great seasonal variations in river flow.



Figure 142. The Niger River



Figure 143. The vegetation of the West African region

Most of West Africa, from the southern Sahara to the humid coastal countries, has only one rainy season, which lasts from one to six months.

Economy

Nigeria is the leading producer of **oil** both in West African region and in the continent. West African countries are united in a regional trade bloc known as The Economic Community of West African States (**ECOWAS**), made up of **15 member countries** that are located in the Western African region. These countries have both cultural and geopolitical ties and shared common economic interest.

West Africa is the **European Union's** largest trading partner in Sub-Saharan Africa. The EU supplies a large part of the equipment that contributes to economic growth and development in the region and is the main export market for West African transformed products (fisheries, agribusiness, textile, etc.).

In terms of sectors, West Africa's exports to the EU still consist mainly of fuels and food products (rice etc.). West Africa's imports from the EU consist of fuels, food products, machinery, and chemicals and pharmaceutical products.

Development and Infrastructure

West African economic growth rates have been insufficient in most countries to make significant reductions in poverty. Essentially, West Africa's farmers and firms produce and trade in highly localized markets and do not achieve the sufficient economies of scale required to attract broad-based investment that could accelerate growth and reduce poverty.

This is due to a number of constraints including inefficient transportation and trade barriers along corridors and at borders, a heavy reliance on family and informal sources of financing, and an insufficient supply of reliable and affordable power. These factors result in West African products being less competitive in the international market place.

North Africa leads the continent in development followed by Southern Africa, West Africa, east Africa and finally central Africa.

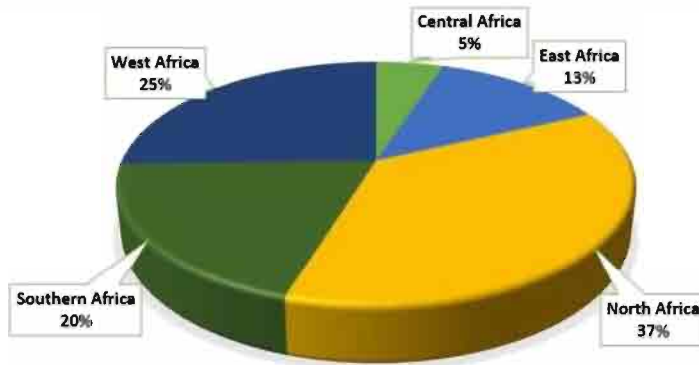


Figure 144. Proportions of African development per region in 2015

Population and Distribution

The West African population is not evenly distributed. It has some areas that are densely, moderately, and sparsely populated.

- **Areas with dense population** are Lagos, Accra, Abidjan, Freetown, Dakar, Monrovia etc.
- **Areas with moderate population** are Bamako, Niamey, and Republic of Benin etc.
- **Areas with sparse population** are Mali, Mauritania, Upper Volta, Northern Niger and Middle belt of Nigeria.

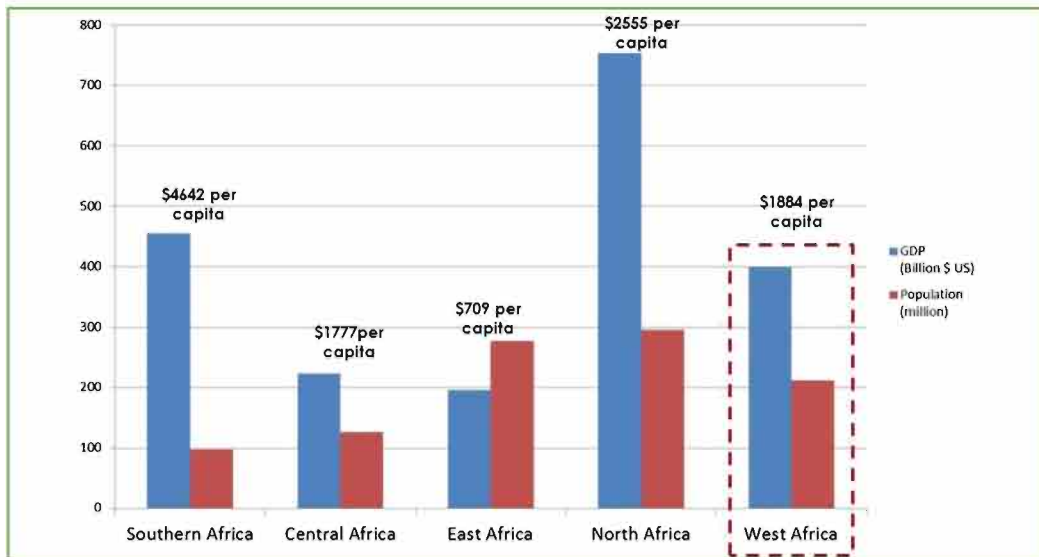


Figure 145. Regional population distribution in relation to economic growth (G.D.P)

Progress Check: Comparing East African and West African regions



We now have a clue about the East and West African regions.

In your respective groups, outline the key features of the West African region as compared to East African region. Create a table to show the similarities and differences between the two African regions.

The North African Region



Figure 146. Countries within the North African region.

North Africa is a collective term for a group of Mediterranean countries and territories situated in the northern-most region of the African continent. The term "North Africa" has no single accepted definition. It is sometimes defined as stretching from the **Atlantic shores of Morocco** in the west, to the **Suez Canal** and the **Red Sea** in the east. Others have limited it to the countries of Algeria, Morocco, and Tunisia, a region known by the French during colonial times as "**Afrique du Nord**" and by the Arabs as the Maghreb ("West"). The most commonly accepted definition includes **Algeria, Morocco, and Tunisia**, as well as **Libya** and **Egypt**. "North Africa", particularly when used in North Africa and the Middle East, often refers only to the countries of the Maghreb and Libya. Egypt, due to its greater Middle Eastern associations, is often considered separately.

Culture and language

The countries of North Africa share a common ethnic, cultural and linguistic identity that is unique to this region. The original inhabitants of North Africa are the Berbers and the Egyptians. Between the A.D. 600s and 1000s, Arabs from the Middle East swept across the region in a wave of Muslim conquest. These peoples, physically quite similar, formed a single population in many areas, as Berbers and Egyptians merged into Arab society. This process of Arabization and Islamization has defined the cultural landscape of North Africa ever since.

Economy

In terms of economic development Egypt and Morocco are the leading North African countries. Most of North African countries are oil producing and exporting countries (OPEC) hence rich in terms of oil production. Despite the fact that North Africa is the leading region in Africa economically, the region still faces a slowdown in economic development due to factors such as socio political crises in most North African countries.

The Southern African Region

Southern Africa, southernmost region of the African continent, comprising the countries of **Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe**. The island nation of Madagascar is excluded because of its distinct language and cultural heritage.



Figure 147. Countries within the Southern African region

Relief

The **Kalahari Desert** forms the central depression of the Southern African plateau. Its elevation rises to the Great Escarpment, which flanks the plateau in an almost unbroken line from the **Zambezi River** to Angola. Southern Zimbabwe and much of South Africa are within a region of scrublands and grasslands known as the veld. To the southeast of the veld is the **Drakensberg range**, which includes the region's highest peak: Lesotho's **Mount Ntlenyana**, at **11,424 feet (3,482 metres)**. In Namibia the coastal margin includes the extremely dry **Namib Desert**, which, in the south, merges eastward into the great sandy expanse of the Kalahari.

Economy

The region is distinct from the rest of Africa, with some of its main exports including **platinum, diamonds, gold, and uranium**, but it is similar in that it shares some of the problems of the rest of the continent. While colonialism has left its mark on the development over the course of history. Today poverty, corruption, and HIV/AIDS are some of the biggest factors impeding economic growth. The pursuit of economic and political stability is an important part of the region's goals, as demonstrated by the SADC. In terms of economic strength, South Africa is by far the dominant power of the region. South Africa's GDP alone is many times greater than the GDPs of all other countries in the region.



Figure 148. Left, Johannesburg the capital city of South Africa and right, Cape Town, South Africa.



Case study 15

Research and Group discussion and presentation-**The Central African Region**

Organize yourselves in groups and research the following information about Central African region:

- Countries located within the region. (**draw a well labelled map**)
- Major relief features.
- Economic, cultural and religious description of the region.



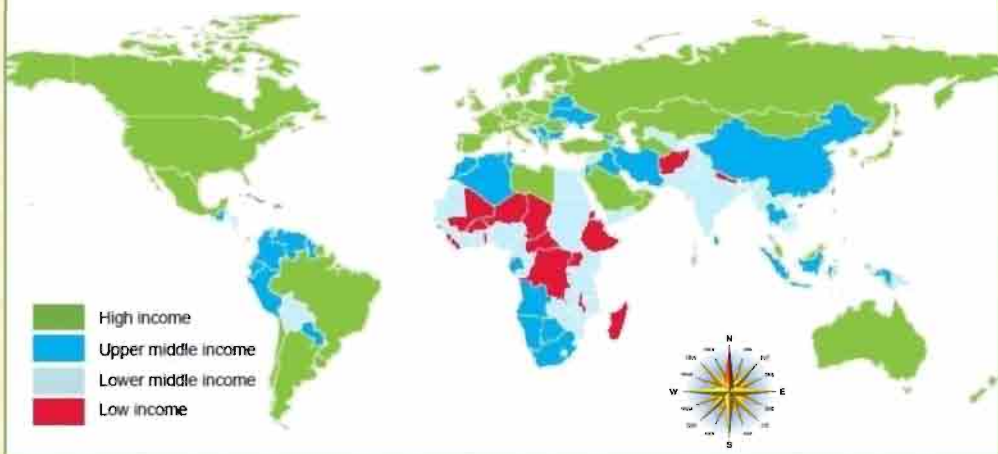
Case study 16

Comparing and Contrasting Regions

Tackle the following investigative question in groups. (Use any relevant reference material as instructed by the teacher)

- ✿ According to the lesson, how can you gauge the development of the East African region in comparison to other African regions?
- ✿ Describe the major geographical features found in the East African region.
- ✿ What are the major economic activities in the East African region?
- ✿ What are some of the challenges that the West African region face?
- ✿ Which trade blocs are found in the following regions;
 - a) East African region.
 - b) West African region.
 - c) Southern African region.
 - d) Central African region.
 - e) North African region.
- ✿ How does the development in Africa compare with other regions in the world?
(Use the data below to justify your answer)

World Economic Growth (2017)



Unit 8

BRIDGING THE “DEVELOPMENT GAP”

Understanding the “Development Gap”

“The Development Gap” refers to the widening difference in levels of development between the world’s richest and poorest countries. This development gap can occur within rich and poor countries for example between regions and between urban and rural areas.

In terms of development, the world can be divided into two halves: the Rich North and The Poor South. The line that divides the two regions is called the Brandt line. Look at the picture below:

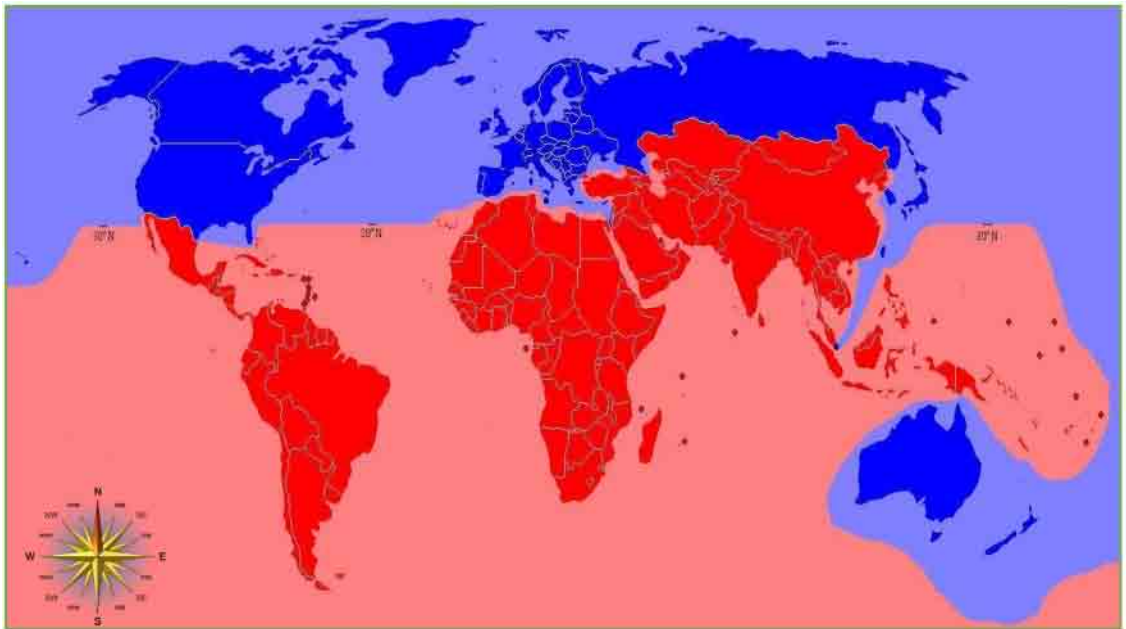


Figure 149. The Global “development gap”. (Red colour represents poor and low income countries while the blue color represent rich and high income countries)

The two economic regions of the world are mutually dependent of each other however, the North region is perceived to develop economic barriers against the growing industrialization of the south by exploiting their natural resources for their own economic benefits.

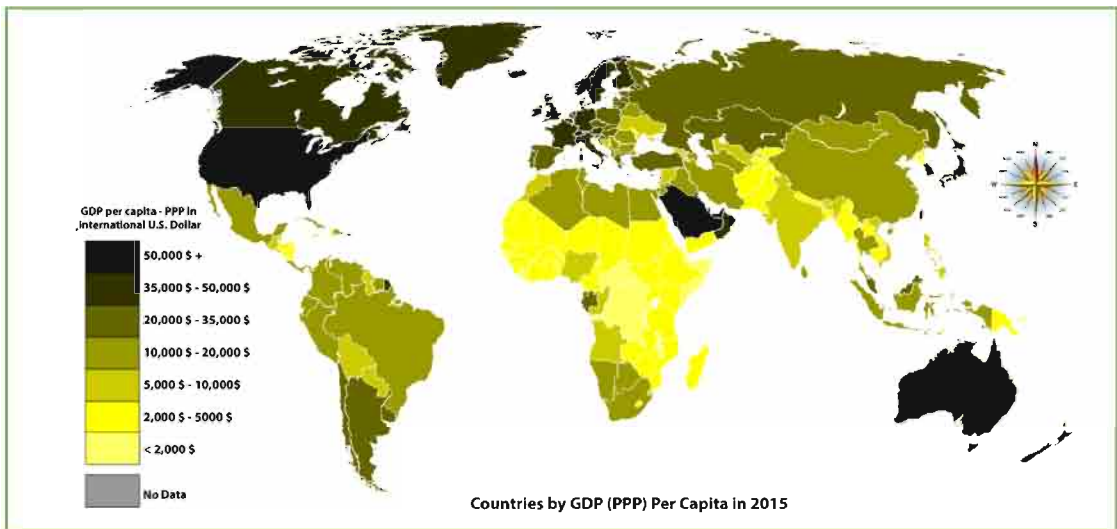
The following are the names of some high income countries: *Australia, Canada, France, Germany, Italy, Japan, Norway, Sweden, Switzerland, and the United States.*

Ways of measuring the “Development Gap”

There are many measures that can help us to understand development. Economic development is measured either by GDP (Gross Domestic Product) per capita or GNI (Gross National Income) per capita.

Gross Domestic Product and Gross National Income

It is important to understand the difference between GDP and GNI. GDP refers to the total value of all goods and services produced by a country in a year. GNI is similar to GDP except that as well as taking into account the total value of goods and services produced by a country, it also includes the income that the country earns as a result of investments in other countries. Per capita means that the total number generated from a measure (eg. GDP or GNI) is then divided by the population of the country to give the final figure. In 1981 a map was created based on GDP per capita where an imaginary line (the Brandt line) was used to divide the map into ‘the rich North’ and ‘the poor South’. This was where it was noted that the countries with the highest GDP per capita were generally in the Northern Hemisphere, and those with the lowest GDP were generally in the Southern Hemisphere.



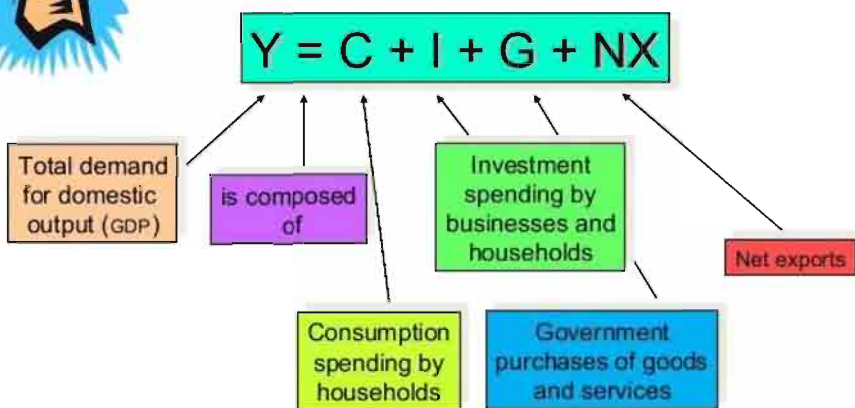
From the map above, how can you gauge south Sudan's GDP in relation to other regions?

Components of GDP

GDP is the sum of the following elements:



The Components of GDP



- Total domestic consumption:** This is the total amount spent on domestically produced final goods and services. Final goods are items that will not be resold or used in production within the next year — milk, cars, bow ties, and so on.
- Total domestic investment expenditures:** This measurement includes not only investments in stocks and bonds, but also investments in equipment — such as bulldozers, computer servers, and commercial buildings — that will be useful over a long period of time. It also includes inventory goods (final goods waiting to be sold that a company still has on hand).
- Government expenditures:** This includes everything from paying military salaries to building roads and maintaining monuments, but does not include welfare and social security payments.
- Net exports:** Net exports is the total of goods and services produced domestically and sold to foreigners minus goods and services produced by foreigners but sold domestically (imports).



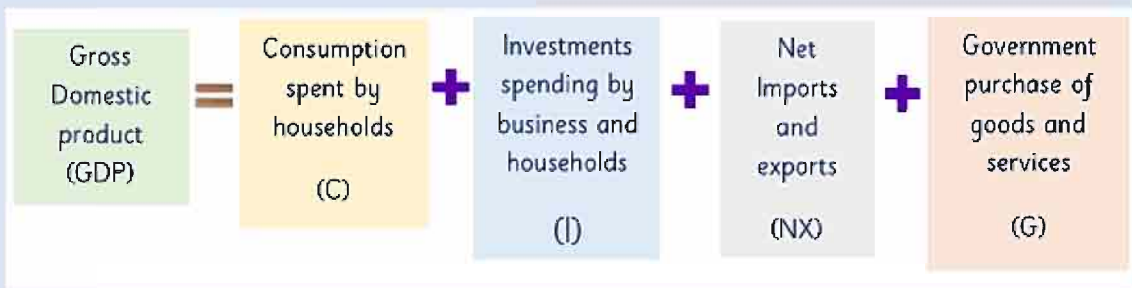
Comprehensive activity 4

Calculating Gross Domestic Product (G.D.P)

1. BMW is a German car manufacturing company. Place each of the following transactions in one of the four components of expenditure for the German economy (**C, I, G, NX**):
 - BMW sells a car to a German Household.
 - BMW sells a car to a US resident.
 - BMW sells a car to the German government.
 - BMW makes a car to be sold next year.
2. South Sudan government has nominated you to become a secretary in the ministry of Finance. Using the data in the table below, calculate the Gross Domestic product of South Sudan.

Item	Amount spent
Government purchases of goods and services	500,000 USD
Net imports	2,000,000 USD
Investments spending by businesses and households	100,000 USD
Consumption spending by households	800,000 USD

Note: Use the formula below:



Gross National Income is the sum of a nation's Gross Domestic Product and the net income it receives from overseas. Like Gross Domestic Product (GDP), Gross National Income (GNI) is a measure of a country's income. Whereas GDP only counts income received from domestic sources, however, GNI includes net income received from abroad. GNI has come to be preferred to GNP, for example by the World Bank.

To calculate GNI, compensation paid to resident employees by foreign firms and income from overseas property owned by residents are added to GDP, while compensation paid by resident firms to overseas employees and income generated by foreign owners of domestic property are subtracted. Product and import taxes that are not already accounted for in GDP are also added to GNI, while subsidies are subtracted. Residence, rather than citizenship, is the criterion for determining nationality in GNI calculations, so long as the residents spend their income within the country.



One of the main differences between the two, is that the Gross Domestic Product is based on location, while Gross National Income is based on ownership. It can also be said that GDP is the value produced within a country's borders, whereas the GNI is the value produced by all the citizens.

Well, it is easier to understand with an example.

Suppose a firm in South Sudan has an establishment in Uganda, the profits from the products will not be part of the Uganda's Domestic product, as the production has not taken place in another area. However, this would count towards South Sudan's Gross National Income, as the firm is owned by South Sudan's citizens even though it is located in the country.



Progress Check

Read the news article below. Discuss why GDP is perceived as an ineffective tool of measuring development.



Time to leave GDP behind

Gross domestic product is a misleading measure of national success. Countries should act now to embrace new metrics, urge **Robert Costanza** and colleagues.

Robert F. Kennedy once said that a country's gross domestic product (GDP) measures "everything except that which makes life worthwhile." The metric was developed in the 1930s and 1940s amid the upheaval of the Great Depression and global war. Even before the United Nations began requiring countries to collect data to report national GDP, Simon Kuznets, the metric's chief architect, had warned against equating its growth with well-being.

GDP measures mainly market transactions. It ignores social costs, environmental impacts and income inequality. If a business

used GDP-style accounting, it would aim to maximize gross revenue — even at the expense of profitability, efficiency, sustainability or flexibility. That is hardly smart or sustainable (think Enron). Yet since the end of the Second World War, promoting GDP growth has remained the primary national policy goal in almost every country.

Meanwhile, researchers have become much better at measuring what actually does make life worthwhile. The environmental and social effects of GDP growth

➔ NATURE.COM

For more on sustainable development goals: go.nature.com/trayjn

can be estimated, as can the effects of income inequality³. The psychology of human well-being can now be surveyed comprehensively and quantitatively⁴. A plethora of experiments has produced alternative measures of progress (see Supplementary Information; go.nature.com/bnqxnx).

The chance to dethrone GDP is now in sight. By 2015, the UN is scheduled to announce the Sustainable Development Goals, a set of international objectives to improve global well-being. Developing integrated measures of progress attached to these goals offers the global community the opportunity to define what

Summary

- Gross Domestic Product (GDP) is the value produced within a country whereas the Gross National income is the value produced by all citizens.
- GDP is said to be the measure of a country's overall economic output. Gross National Income (GNI) is the total value that is produced within a country, which comprises of the Gross Domestic Product along with the income obtained from other countries.
- Gross Domestic Products helps to show the strength of a country's local income. On the other hand, Gross National Income helps to show the economic strength of the citizens of a country.

Advantages and disadvantages of the ways of measuring the Development Gap

Advantages of Gross Domestic Product (GDP)

Using GDP as a measure of a nation's economy makes sense because it's essentially a measure of how much buying power a nation has over a given time period. GDP is also used as an indicator of a nation's overall standard of living because, generally, a nation's standard of living increases as GDP increases.

But there are a number of shortcomings to using GDP. Here are just a few:

Disadvantages of Gross Domestic Product (GDP)

- **GDP doesn't count unpaid volunteer work:** GDP doesn't take into account work that people do for free, from an afternoon spent picking up litter on the roadside to the millions of man-hours spent on free and open source computer soft wares. In fact, volunteer work can actually lower GDP when volunteers do work that might otherwise have gone to a paid employee or contractor.

- **Disasters can raise GDP:** Wars require soldiers, oil spills require cleanup, and natural disasters require health workers, builders, and all manner of helping hands. Rebuilding after a disaster or war can greatly increase economic activity and boost GDP.
- **GDP doesn't account for quality of goods:** Consumers may buy cheap, low quality, short-lived products repeatedly instead of buying more expensive, longer lasting goods. Over time, consumers could spend more replacing cheap goods than they would have if they had bought higher-quality goods in the first place, and GDP would grow as a result of waste and inefficiency.



Case study 17

Recall: Understanding GDP and GNI in relation to South Sudan's economy (group discussion)

Tackle the following investigative question in groups. (Use any relevant reference material as instructed by the teacher)

From the lesson, we learnt that Gross Domestic Product (GDP) is the measure of a country's overall economic output while the gross national income (GNI) is the total value that is produced within a country, which comprises of the Gross Domestic Product along with the income obtained from other countries.

1. In groups, research on which of the following statements are true:
 - a) The GDP of South Sudan is the same as its GNI.
 - b) The GNI of South Sudan is higher than its GDP.
 - c) The GDP of South Sudan is lower than its GNI.
2. What could be the reason behind the following economic circumstances?
 - a) An increase in a country's Gross Domestic Product (GDP)
 - b) A decrease in a country's Gross Domestic Product.
3. Discuss the advantages and disadvantages of Gross Domestic Product (GDP) as a way to measure the development of a region.

Why is the Development Gap growing?

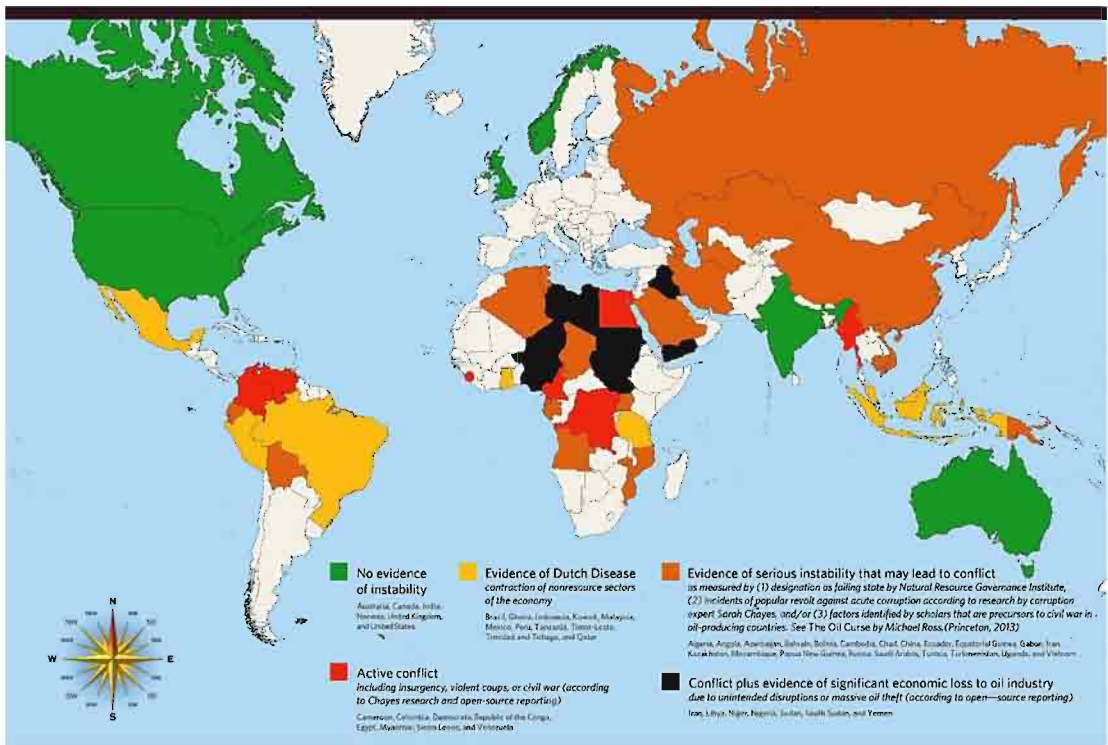
Geographical factors

There are geographical barriers to development such as the existence of natural resources (oil, coal, gas etc.). Countries with adequate natural resources tend to develop more than those with fewer natural resources.

However conflict over the control of valuable natural resources such as oil supplies has been a persistent feature of international affairs since the beginning of the 20th century. Such conflict varies in nature, ranging from territorial disputes over the possession of oil-laden border areas to dynastic or factional struggles among the leaders of oil-rich countries to major inter-state wars over the control of vital oil zones. As oil becomes more scarce and valuable, the frequency and severity of such conflict is likely to increase. Such conflicts hinder development in countries with valuable natural resources.

Spreading Instability in Oil-Producing Countries

Corruption, conflict, and economic loss since



National access to sea and oceans can also cause a gap in development. Landlocked countries face threats of high taxations on imports and exports by coastal countries. On the other hand a country may experience a slow rate of development if the landscape of a country is extremely mountainous or mostly desert then the country is termed a development hazard hotspot.

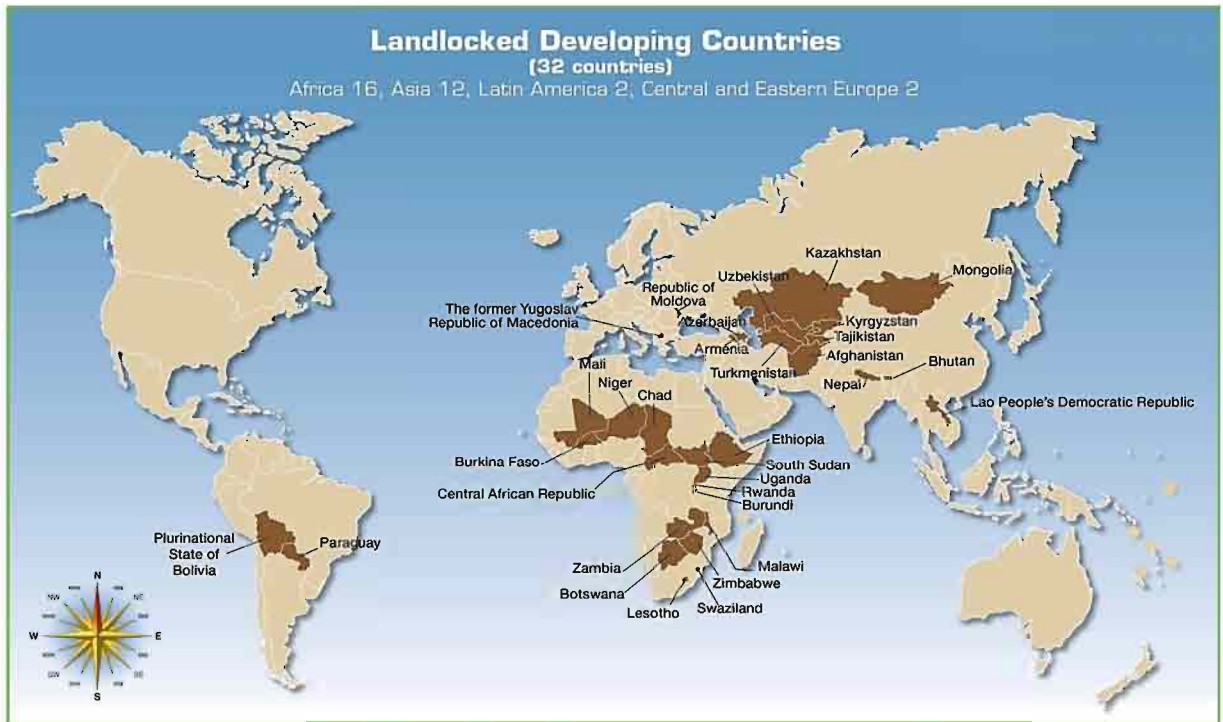


Figure 150. Landlocked low income countries in the world.

Economic factors

Skewed economic ideologies

One reason why the development gap is growing is due to the skewed economic and political ideologies of the west, with the superpower of the USA being dominant in large global organizations, such as the IMF (International Monetary Fund), which was set up in order to bridge the development gap. With the USA being dominant within the IMF and the WTO (World Trade Organization), few bills are passed in order to help the developing world.

Trade bias

Furthermore, trade is biased, with farmers in the developing world being paid far less for their goods than those in the developed world. A good example of this is the cotton trade, which is subsidized in America but not across the continent of Africa, therefore making it harder for farmers to grow the agricultural product that America produces.

Differences in agricultural technologies

High income countries have embraced new technologies in the field of agriculture. However, their developing counterparts still use old methods of farming. Increased productivity in agriculture has been achieved in several parts of the world mainly by modernizing agriculture. Modernization consists largely of using improved seeds, modern farm machinery such as tractors, harvesters, threshers, etc., chemical fertilizers and pesticides in an optimal combination with water.

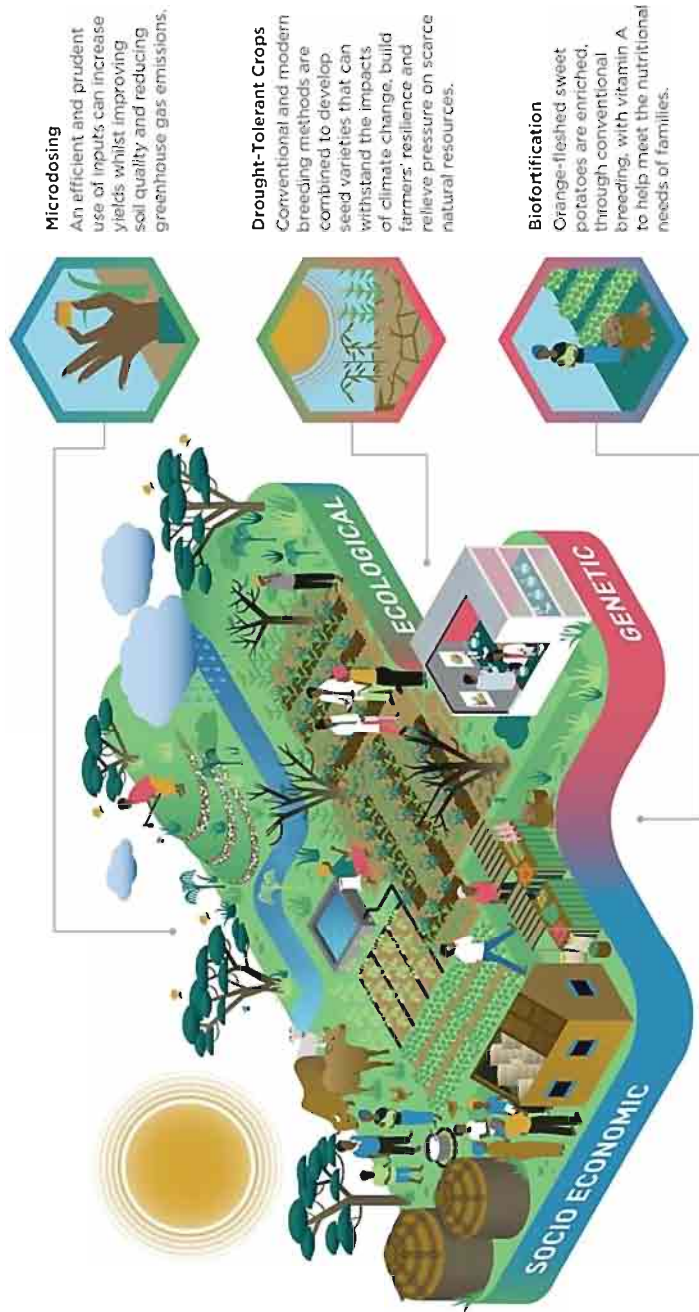
The contribution of extensive cultivation has not been significant of late. Bringing more land area under agriculture is becoming more and more difficult in most countries. Since prosperous agriculture is considered to be the most crucial base for economic development particularly in the low income countries, the only viable option for them is to continue to enhance the productivity of land and labour in agriculture. The difference in agricultural development between the high income and low income countries is due to modernization of agriculture where low income countries still use traditional methods of farming.



Figure 151. The different farming technologies between the north and the south.

WHAT DOES SUSTAINABLE INTENSIFICATION IN AFRICAN AGRICULTURE LOOK LIKE?

Sustainable Intensification integrates innovations and practices from the fields of ecology, genetics and socio-economics to build environmentally sustainable, equitable, productive and resilient ecosystems that improve the well-being of farmers, farmers and families.



Helpful techniques to improve agricultural production in Africa

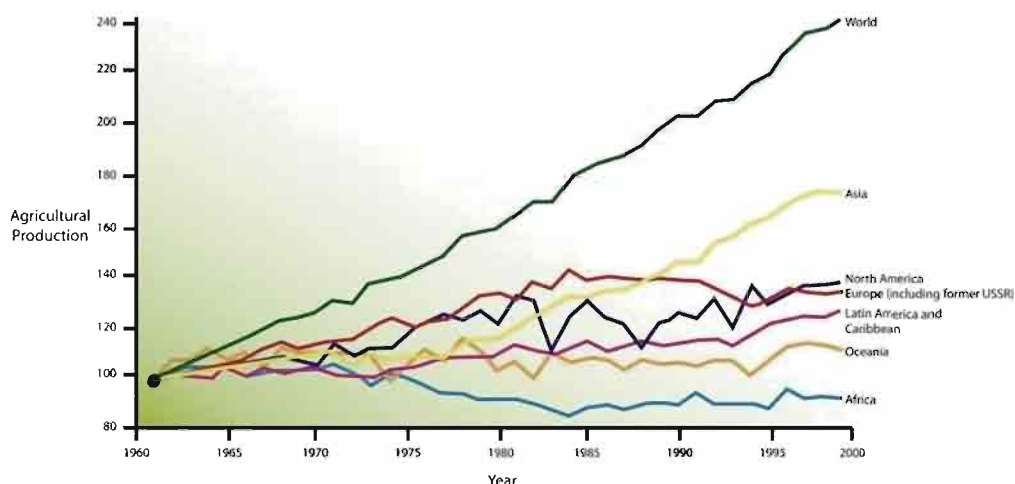


Case study 18

Research - The leading regions in the world in terms of agricultural production.

Look at the graph below and answer the questions that follow in groups:

World Food Supply



- Describe the graph above in three different sentences.
- Which region is least productive in agriculture according to the graph? What could be the reason for this?
- Which regions lead in terms of agricultural production and why?
- Where does South Sudan's agricultural production lie on the graph? Discuss.
- How can South Sudan improve its agricultural productivity?

Overreliance on foreign aid

Moreover, aid can hinder the development of the country if given inefficiently. For instance, long term aid of food and shelter to a developing or war torn country, can in fact prevent the population from developing their country and providing an income through farming and other practices.

A country may become reliant on the aid from a high income country in order for themselves to become developed. But this could encounter problems such as the low income country not building up their own economic structure and support system, and relying on other countries. This can be risky, as the high income country has performed soft power on the low income country. In addition, large infrastructural projects can be a form of aid, which has been seen in many African nations by China, even spreading to Brazil which China funding a new rail path to connect the ports, and even in our own country with the new nuclear power plant in the early stages of planning. This soft power increases the development gap as the high income country exercising this power will become more affluent and more powerful.

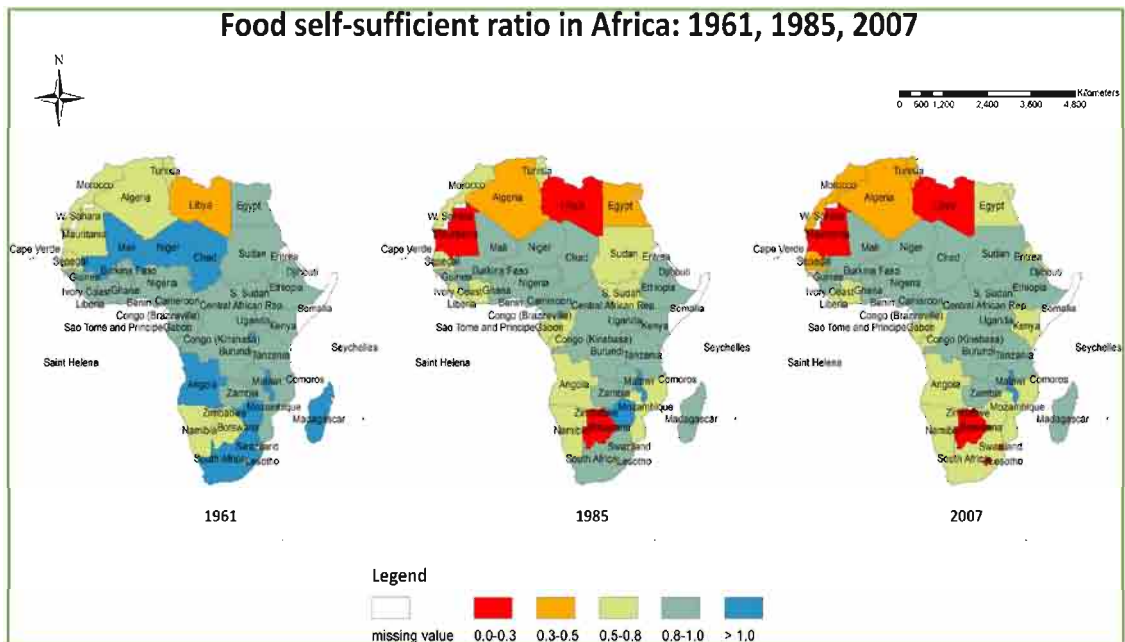


Figure 152. Food self-sufficient ratio in Africa. (1961-2007)



Case study 19

Reducing dependency on high income countries

Tackle the following investigative question in groups. (Use any relevant reference material as instructed by the teacher)



Figure 153. Uploading of humanitarian aid essentials for displaced people at Mbella Camp, Central African Republic (CAR)

- ✿ Most nations in Africa depends mostly on High income countries such as the United States of America, China and the United Kingdom for financial aid and food aid among others. What are the results of over dependency?
- ✿ How can low income countries within the continent reduce foreign dependency?

Social factors

Political instability

Political instability is the tendency of a government to collapse either because of conflicts or rampant competition between various political parties. This could be because of ethnic tension, tribalism, or all-out war. Needless to say, countries with long-term conflicts such as the ones in Somalia or Afghanistan, have little chance of developing. Other nations such as Sri Lanka, have simmering ethnic divides that are a constant distraction, de-stabilizing the region and discouraging investment. Economic growth and political stability are deeply interconnected. Without political stability, a country will not easily develop. Political instability is evident in most low income countries. See the conflict and political violence index below:

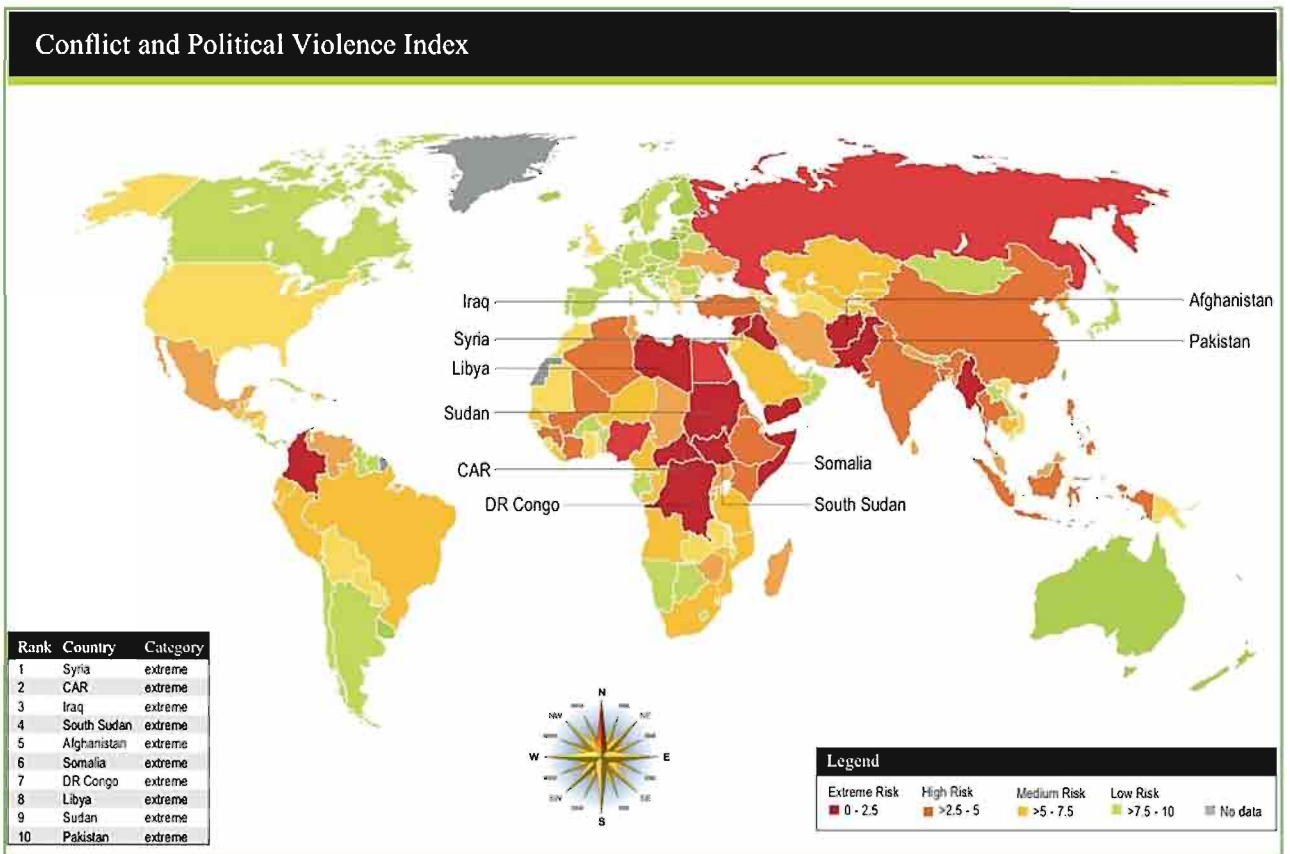


Figure 154. Global conflict and political violence index. (2017)



Comprehensive Activity 5

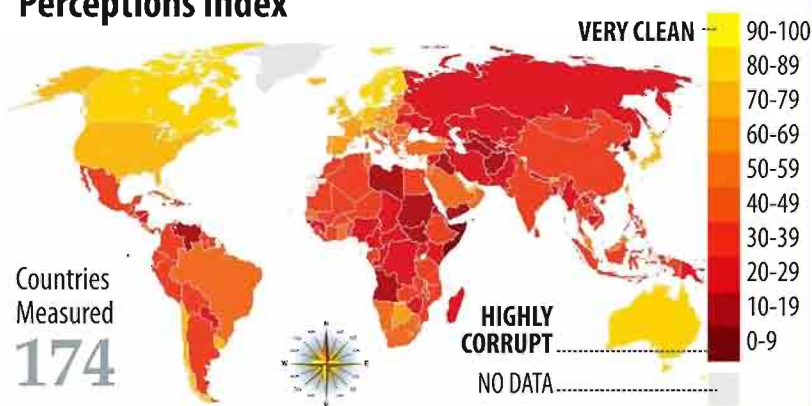
War and development



In groups, Investigate why social and political unrest can result in geographical differences in wealth and development. Use the example of African countries to justify your answer. **Note:** Present your finding to the class.

Corruption and development

CORRUPTION (Countries ranked according to their perceived levels of public-sector corruption) **Perceptions Index**



From the data provided above, discuss how corruption affects development. Suggest some reasons for corruption and how these might be addressed.

Industrialization

High income nations are more industrialized and have high per capita income (also referred to as Gross Domestic Product). They have large manufacturing and processing industries that help sustain the rapidly rising economic development of their countries. High income nations are also characterized by their use of natural resources to increase economic production. Revenues are efficiently and effectively utilized in high income countries.



Figure 155. An aircraft manufacturing and assembling plant at Renton near Seattle, USA

On the other hand, low income nations in Africa and the Middle East have low industrial production. These types of nations generate their income from service industries. Despite the fact that they have abundant natural resources, they depend on financial aid from high income countries to exploit their resources.



Figure 156. (Left) A man having a haircut at a barbershop, and (right) a woman having her hair tended to at a local hair salon in Juba South Sudan. Low income countries generate most of their revenue from the service sector.

COMPARISON CHART

BASIS OF COMPARISON	HIGH INCOME COUNTRIES	LOW INCOME COUNTRIES
Meaning/ definition:	A country having an effective rate of industrialization and individual income is known as a high income country.	A low income country is a country which has slow rate of industrialization and low per capita income.
Unemployment and poverty	Low	High
Life and death rates	Infant mortality rate, death and birth is low while life expectancy rate is high.	High infant mortality rate, death rate and birth rate, along with low life expectancy.
Generates more revenue from:	Industrial sector	Service sector
Growth	High industrial growth	They rely on the high income countries for their growth
Standard of living	high	Low
Distribution of income	Equal	Unequal
Factors of production	Effectively utilized	Ineffectively utilized



Jane was asked to write down the differences between high income countries and low income countries on the chalk board. : Rank these differences from the most significant reasons to the least significant.

Key differences between high income and low income countries.

The following are the major differences between high income countries and low income countries:

1. The countries which are independent and prosperous are known as high income countries. The countries which are facing the beginning of industrialization are called low income countries.
2. High income countries have high per capita income and GDP as compared to low income countries.
3. In high income countries, the literacy rate is high, but in low income countries the illiteracy level is high.
4. High income countries have good infrastructure and better environment in terms of health and safety, which is absent in the low income countries.
5. High income countries generate revenue from the industrial sector. Conversely, low income countries generate revenue from the service sector.
6. In high income countries, the standard of living of people is high, which is moderate in low income countries.
7. Resources are effectively and efficiently utilized in high income countries. On the other hand, proper utilization of resources is not done in low income countries.
8. In high income countries, the birth rate and death rate are low, whereas in low income countries, both rates are high.

Measures to bridge the “Development gap”

The world economy is not based on equitable distribution of wealth. Some countries are economically poor whereas others such as the USA are very rich and prosperous. There are some nations which are in the developing process, but have a long way to reach the level of development that developed economies enjoy.

How to narrow the gap between the rich and poor nations

The following are some of the measures to bridge the development gap between low income countries and high income countries:



Figure 157. Bridging the developmental gap

- Focus of the world bodies such as the UNESCO and the United Nations as well as the World Bank should be more inclined towards ensuring unbiased distribution of the world's natural resources. The international community should sympathize and appreciate the problems of the poorer nations and try to solve them.
- The sharing of technology and information should continue at rapid pace so that the poorer nations can benefit from modern techniques of operations that are available in the high income countries.
- The high income nations should also accept the poorer nations to be on the same level with them and appreciate their independent status. Too much interference by high income nations in the affairs of low income nations is not good since it affects their progress.

- Social and communication barriers need to be reduced so that there is a more friendly interaction between the two sections of the countries.
- An air of superiority among the high income nations and the belief that poorer nations are ethnically also backward must not be there. Racial superiority can affect the growth of the nation which is discriminated against. In South Africa, apartheid only indicates the white superiority. Racial differences ought to be solved since everyone is equal.
- Low income countries should stop relying on high income countries for development and instead use their readily available natural resources to develop themselves.
- Corruption and social conflict should be eradicated since these are hindrances to development.
- Low income countries should focus on using their local skills and resources to industrialize themselves. Industrialization can speed up the development of a country since goods sold domestically and exported overseas will add up to the country's gross national income.
- Low income nations especially African countries should use modern agriculture as a tool to eliminate food shortage. This will intern help them stop depending on foreign aid.



Figure 158. The use of modern farming machines such as tractors, combine harvesters, biodegradable pesticides, organic manure and high quality improvised seeds are examples of modern ways of farming.



Exercise 9

Answer the following questions:

1. What do you understand by the “development gap”
2. What is the “Brandt line?”
3. Define the following terms:
 - a) High income nations
 - b) Low income nations.
 - c) Gross Domestic Product (GDP).
 - d) Gross National Income (GNI).
4. What are some of the ways of measuring the development gap?
5. What is the reason behind the widening of the development gap and how can it be bridged?
6. What are the major differences between high income and low income countries?
7. Discuss how the following factors affect the development of a country:
 - a) Existence of natural resources.
 - b) Inaccessible landscapes.
 - c) Political instability.
 - d) Social and political conflict.
 - e) Overreliance on foreign aid.
 - f) High industrial productivity.
 - g) Corruption.
8. As a citizen of South Sudan, discuss some of the ways that your nation can grow economically.

Unit 9

INTERNATIONAL TRADE

What is International Trade?

International trade is the exchange of capital, goods, and services across international borders or territories. It is the exchange of goods and services among nations of the world.

Characteristics of International Trade

Trading globally gives consumers and countries the opportunity to be exposed to new markets and products. Almost every kind of product can be found in the international market: food, clothes, spare parts, oil, jewelry, wine, stocks, currencies, and water. Services are also traded: tourism, banking, consulting, and transportation. A product that is sold to the global market is an export, and a product that is bought from the global market is an import. Imports and exports are accounted for in a country's current account in the balance of payments.



Figure 159. An Artistic representation of International Trade

Industrialization, advanced technology, including transportation, globalization, multinational corporations, and outsourcing are all having a major impact on the international trade system. Increasing international trade is crucial to the continuance of globalization. Nations would be limited to the goods and services produced within their own borders without international trade. International trade is, in principle, not different from domestic trade as the motivation and the behavior of parties involved in a trade do not change fundamentally regardless of whether trade is across a border or not.

The Differences between Domestic and International Trade

The main difference is that international trade is more expensive than domestic trade. This is due to the fact that international borders levies additional costs such as tariffs, time costs due to border delays, and costs related with country differences such as language, the legal system, or culture.

Another difference between domestic and international trade is that factors of production such as capital and labor are more mobile within a country than across countries. Thus, international trade is mostly restricted to trade in goods and services, and only to a lesser extent to trade in capital, labor, or other factors of production. Trade in goods and services can serve as a substitute for trade in factors of production.

Instead of importing a factor of production, a country can import goods that make intensive use of that factor of production and thus embody it. An example of this is the import of labor-intensive goods by the United States from China. Instead of importing Chinese labor, the United States imports goods that were produced with Chinese labor.

Free Trade

Free trade is the concept that trade should occur between countries with as few restrictions or limitations as possible. Unfortunately, there are very few areas in the world with 100% free trade. Every country has a complex set of taxes on foreign goods (called tariffs), limits on how many goods can be brought in (called quotas) and outright restrictions on importing certain things. When people talk about 'free trade' they are talking about removing, or lessening some of these restrictions.



Figure 160. An artistic impression of free trade.

A free trade area (FTA) is where there are no import tariffs or quotas on products from one country entering another.



Figure 161. Free trade areas in the world

There are arguments that free trade makes it harder for countries to develop from poor to rich. If every country specializes in what they're 'best' at making, poorer countries can get stuck specializing in lower wage industries like mining, fishing or farming. Instead they argue that some degree of protectionism is needed to build up more advanced industries.

Examples of free trade areas include:

- **EFTA:** European Free Trade Association consists of Norway, Iceland, Switzerland and Liechtenstein
- **NAFTA:** United States, Mexico and Canada (being renegotiated)
- **SAFTA:** South Asian Free Trade Area comprising Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka
- **Pacific Alliance:** Chile, Colombia, Mexico and Peru
- There are many bi-lateral free trade agreements signed between two countries or between two regional trading blocs e.g. the recently-signed Australia - China Free Trade Agreement

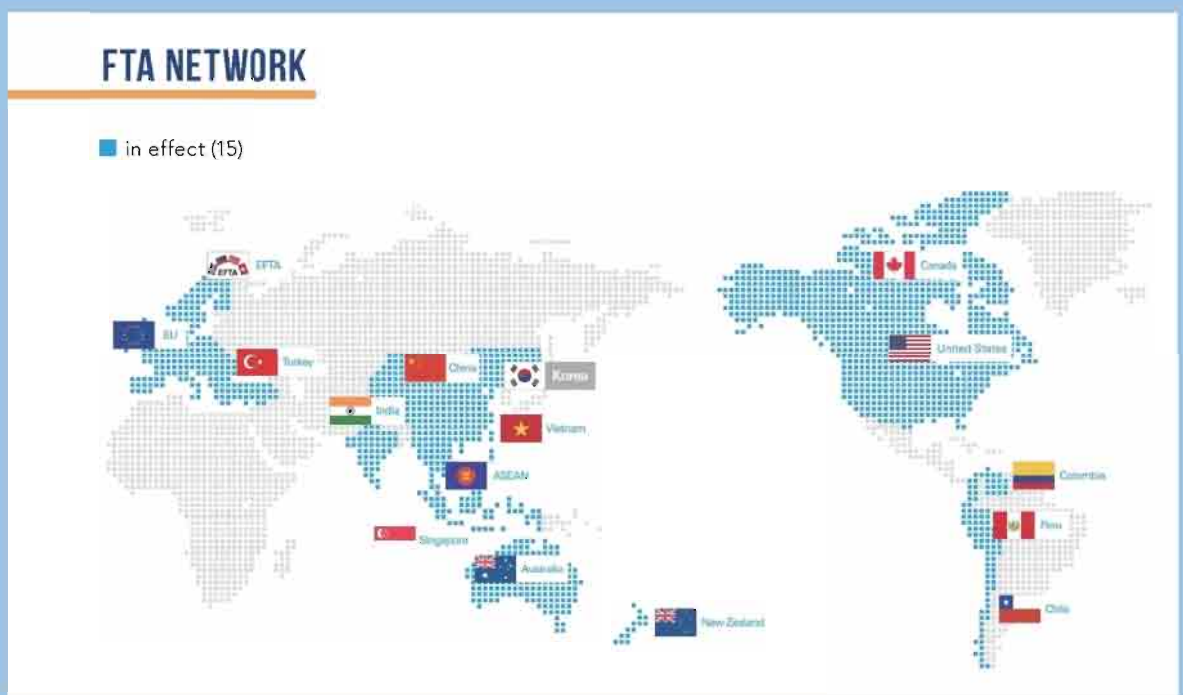


Figure 162. Global free trade areas. (2015)

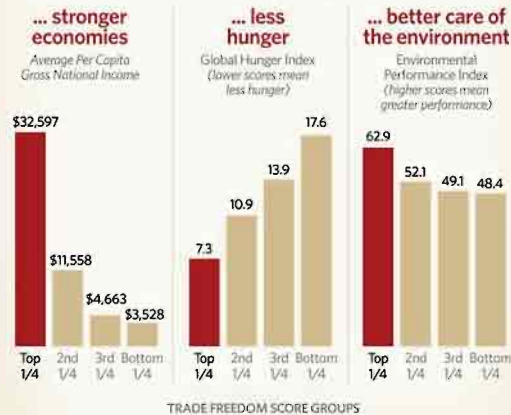
Progress Check: The Benefits of Free Trade



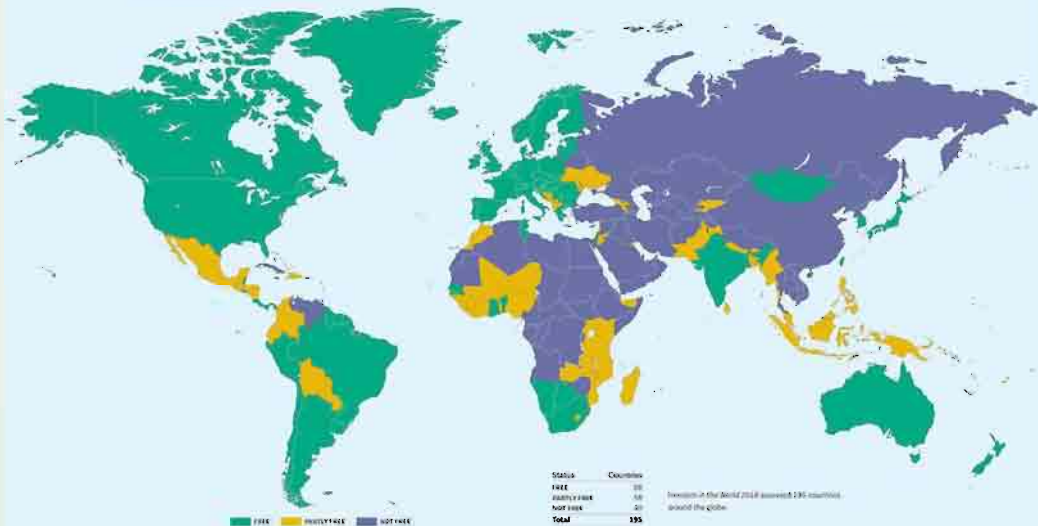
Look at the graphical information provided below:

Major Benefits of Free Trade

The nations of the world are divided into four groups based on their trade freedom scores in the 2013 Index of Economic Freedom. The chart below shows that nations with more trade freedom also have ...



FREEDOM IN THE WORLD 2018



1. From what you have learnt, compare and contrast International trade with free trade.
2. What are the major benefits of free trade?
3. Research on the challenges that FTA countries face. Use any reference material.
4. Can free trade improve the economy of South Sudan? Discuss.



Case study 20

International Trade

Tackle the following investigative question in groups. (Use any relevant reference material as instructed by the teacher)



Figure 163. An artistic impression of international trade

- ✿ What are some of the factors that lead to International trade?
- ✿ What are the advantages and disadvantages of International trade?
- ✿ What is the importance of international trade to Africa and South Sudan in particular?

The World Trade Organization

The World Trade Organization (WTO) is an intergovernmental organization that regulates international trade. It is the largest international economic organization in the world. The WTO deals with regulation of trade in goods, services and property between participating countries by providing a plan for negotiating trade agreements and a dispute resolution process aimed at enforcing participants' adherence to WTO agreements, which are signed by representatives of member governments. It supports the needs of low income countries. World Trade Organization currently has a total of 164 member states across the globe.

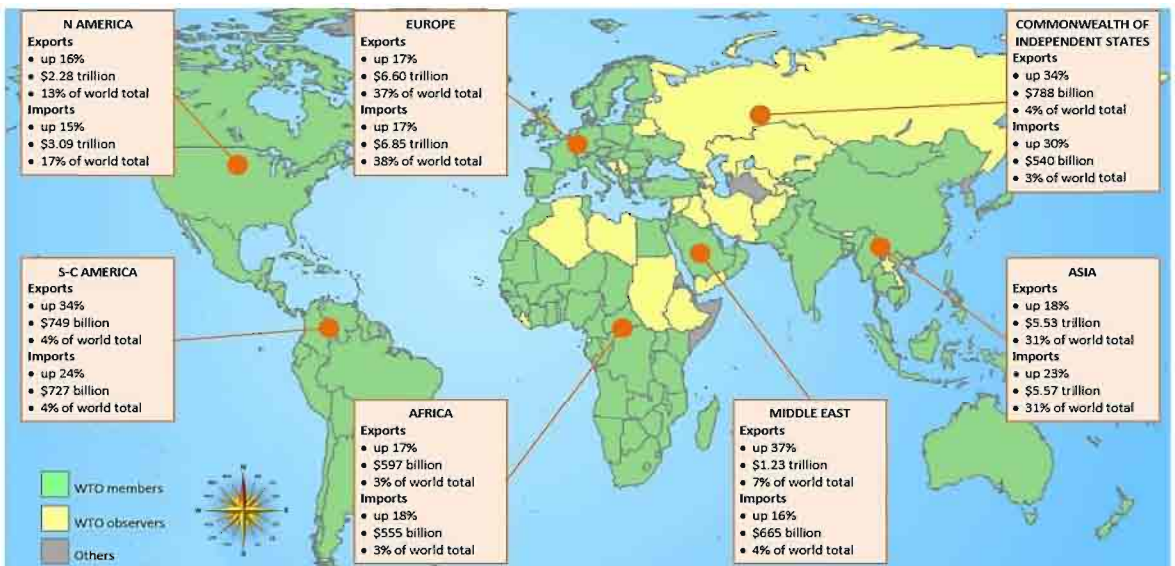


Figure 164. Members of the World Trade Organization

Benefits of the World Trade Organization

It helps restore peaceful coexistence

Peace is partly an outcome of two of the most fundamental principles of the trading system: helping trade to flow smoothly and providing countries with a constructive and fair outlet for dealing with disputes over trade issues. It is also an outcome of the international confidence and cooperation that the system creates and reinforces.

It allows disputes to be handled constructively

As trade expands in volume, in the numbers of products traded, and in the numbers of countries and companies trading, there is a greater chance that disputes will arise. The WTO system helps resolve these disputes peacefully and constructively.

The World Trade Organization works on rules

The WTO cannot claim to make all countries equal. But it does reduce some inequalities, giving smaller countries more voice, and at the same time freeing the major powers from the complexity of having to negotiate trade agreements with each of their numerous trading partners.

The World Trade Organization advocates for free trade

The WTO's global system lowers trade barriers through negotiation and applies the principle of non-discrimination. The result is reduced costs of production (because imports used in production are cheaper) and reduced prices of finished goods and services, and ultimately a lower cost of living.

It creates competition amongst members

The World Trade Organization gives consumers more choice, and a broader range of products to choose from. This makes nations productive in terms of economic produces such as agricultural exports, manufactured and processed goods among others. With more competitors to fight over market share, each company has to constantly look to improve their goods or services or create more value for their customers. This means better products and sometimes lower prices, which is always a good thing for buyers.

Fun Fact: The Structure of the World Trade Organization

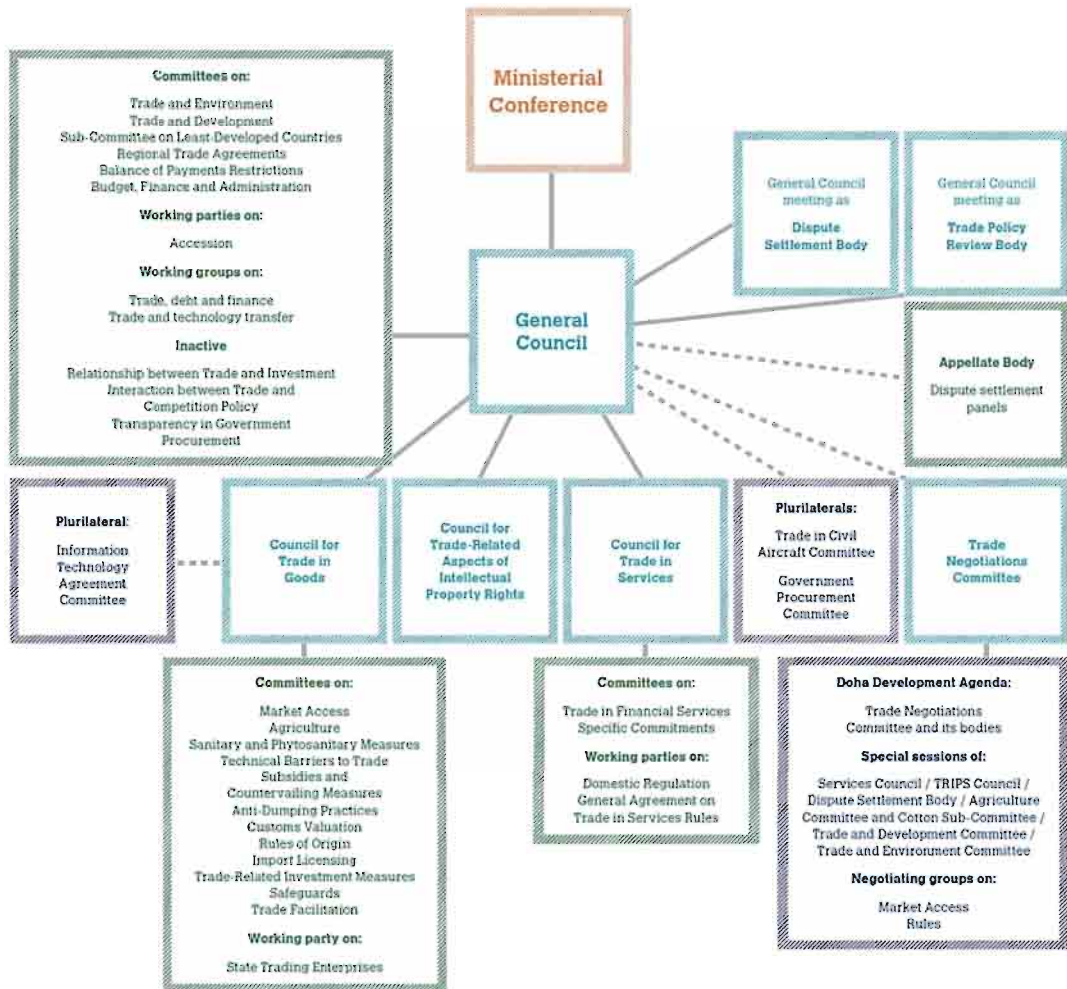


Figure 165. WTO organizational Chart (courtesy WTO)

- The WTO's top level decision-making body is the **Ministerial Conference** which meets at least once every two years.
- Below this is the **General Council** which meets several times a year in the Geneva headquarters. The General Council also meets as the Trade Policy Review Body and the Dispute Settlement Body.
- At the next level, the **Goods Council, Services Council and Intellectual Property (TRIPS)**. This council is under the General council.

- There are numerous **specialized committees, working groups** and **working parties** that deal with the individual agreements and other areas such as the environment, development, membership applications and regional trade agreements.

The Secretariat

The WTO Secretariat, based in **Geneva**, has around 640 staff and is headed by a director-general. Its annual budget is roughly 197 million Swiss francs. It does not have branch offices outside Geneva. Since decisions are taken by the members themselves, the Secretariat does not have the decision-making role that other international bureaucracies are given.

The Secretariat's main duties are to supply technical support for the various councils and committees and the ministerial conferences, to provide technical assistance for developing countries, to analyze world trade, and to explain WTO affairs to the public and media.

The Secretariat also provides some forms of legal assistance in the dispute settlement process and advises governments wishing to become members of the WTO.



Figure 166. The World Trade Organization Secretariat, Geneva, Switzerland.



You are a leader of a country that has just gained its independence recently. Your country needs platforms to conduct trade with other countries of the world. Your finance minister has just advised you to join the World trade Organization among other major key trade blocs in the world.

In groups, **conduct a research on the procedure** that will take place for your country to be **recruited** in the **World Trade Organization**. (Refer to the organizational chart of the WTO on page 185)



Exercise 10

Answer the following questions:

1. Distinguish between international trade and the World Trade Organization.
2. Discuss the benefits of the World Trade Organization.
3. Which countries have signed to the World Trade Organization and why?

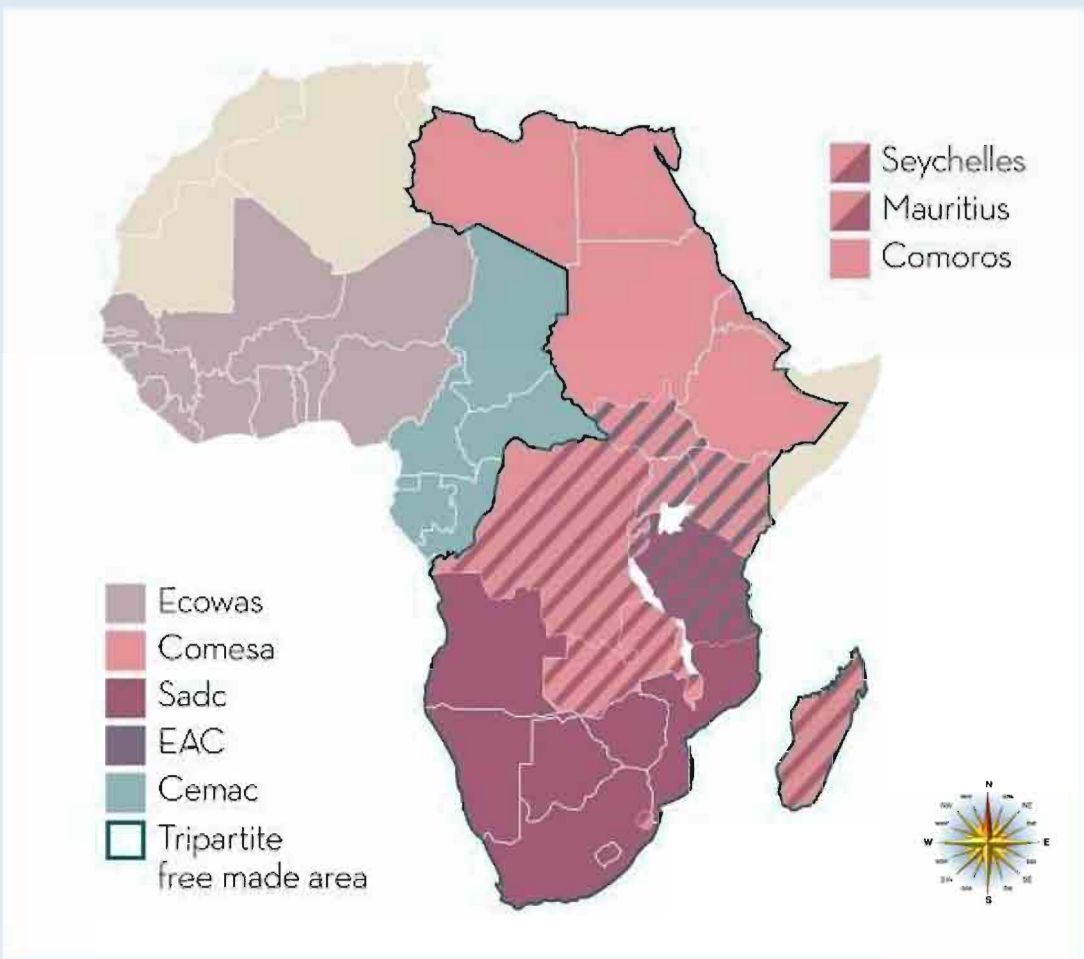


Case study 21

Trading Zones in Africa

Tackle the following investigative question in groups. (Use any relevant reference material as instructed by the teacher)

- ✎ Apart from the World Trade Organization find out more about other regional economic blocs important to the development of African countries. Use the data provided in the map below:



Glossary



1. **Globalization**: the process by which businesses or other organizations develop international influence or start operating on an international scale.
2. **Tariff**: a tax or duty to be paid on a particular class of imports or exports.
3. **Quota**: a limited quantity of a particular product which under official controls can be produced, exported, or imported.
4. **Global warming**: a gradual increase in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, CFCs, and other pollutants.
5. **Biodiversity**: the variety of plant and animal life in the world or in a particular habitat.
6. **Coast**: the part of the land adjoining or near the sea.
7. **Tide**: the alternate rising and falling of the sea.
8. **Sustainability**: avoidance of the depletion of natural resources in order to maintain an environmental balance.
9. **Algal bloom**: a rapid growth of microscopic algae in water, often resulting in a colored scum on the surface.
10. **Aquaculture**: the rearing of aquatic animals or the cultivation of aquatic plants for food.
11. **Harbour**: a place on the coast where ships may anchor for protection against rough waters.
12. **Port**: a town or city with a harbour or access to navigable water where ships load or unload.
13. **Beach**: a sandy shore especially next to the sea or ocean.
14. **Coastal management**: this is the understanding the different uses of coastal land and the physical processes impacting on the coast, such as erosion and longshore drift. It also involves representing the interest and need of each coastal user in order to avoid human conflict.
15. **Renewable energy**: is an energy resource which can be used repeatedly and replaced naturally.
16. **Non-renewable energy**: energy produced by burning fossil fuels such as coal. They are non-renewable because there are limited resources of fossil fuels on the planet.
17. **Biomass**: organic matter used as a fuel, especially in a power station for the generation of electricity.
18. **Coal**: a combustible black or dark brown rock consisting mainly of carbonized plant matter, found mainly in underground seams and used as fuel.

19. **Natural gas:** flammable gas, consisting largely of methane and other hydrocarbons, occurring naturally underground (often in association with petroleum) and used as fuel.
20. **Rocks:** the solid mineral material forming part of the surface of the earth and other similar planets, exposed on the surface or underlying the soil.
21. **Texture:** the feel, appearance, or consistency of a surface or a substance.
22. **Composition:** the general appearance of a substance.
23. **Igneous rocks:** After a volcanic eruption, lava cools and forms igneous rock.
24. **Sedimentary rocks:** these are rocks formed from material transported and deposited by water, wind, or glaciers, or by the secretions of organisms.
25. **Metamorphic rocks:** Metamorphic rock are formed when sedimentary or igneous rock is exposed to high heat and pressure, thus transforming the rock.
26. **Rock cycle:** The rock cycle is a basic concept in geology that describes the time-consuming transitions through geologic among the three main rock types: sedimentary, metamorphic, and igneous.
27. **Erosion:** The action or process of wearing away by the action of water, wind, or glacial ice.
28. **Contact metamorphism:** is a type of *metamorphism* where rock minerals and texture are changed, mainly by heat, due to *contact* with magma.
29. **Regional metamorphism:** is a type of *metamorphism* where rock minerals and texture are changed by heat and pressure over a wide area or region.
30. **Hydrothermal metamorphism:** also called metasomatism, may take place across wide regions of rock, thereby constituting a variant of regional metamorphism. It may alternately may take place in a limited, localized area and constitute a variant of local metamorphism. Hydrothermal metamorphism takes place when hot, volatile solutions percolate into and react with the protolith, or the original rock. The heat of the intrusive igneous body and the hot volatile fluids serves to catalyze
31. **Sluicing:** wash or rinse freely with a stream or shower of water.
32. **Dredging:** clear the bed of (a harbour, river, or other area of water) by scooping out mud, weeds, and rubbish with a dredge.
33. **Placer:** a deposit of sand or gravel in the bed of a river or lake, containing particles of valuable minerals.
34. **Alluvial mining:** a type of mining usually performed in areas of secondary deposits like riverbanks, beaches or even off-shore locations. It involves the building of walls and the diversion of rivers.

35. **Artisanal mining:** a method of mining that involves the screening and straining of mud.
36. **Tailing:** the waste or residue of something, especially a mineral ore.
37. **Development gap:** the widening difference in levels of development between the world's richest and poorest countries.

List of Abbreviations



1. **AU**: The African Union.
2. **CFCs**: Chlorofluorocarbons.
3. **CO₂**: Carbon dioxide.
4. **COMESA**: Common Market for Eastern and Southern Africa.
5. **EAC**: East African Community.
6. **ECOWAS**: Economic Community of West African States.
7. **GDP**: Gross Domestic Product.
8. **GNI**: Gross National Income.
9. **G8**: The group of eight.
10. **HDI**: Human Development Index.
11. **H.E.P**: Hydroelectric Power.
12. **LICs**: Low Income Countries.*
13. **NIC**: Newly Industrialized Countries.
14. **SADC**: Southern African Development Community.
15. **WTO**: The World Trade Organization.
16. **OPEC**: Oil Producing and Exporting Countries.

* Low income countries are also referred to as **emerging market economies**. Previously, they were known as **developing countries**. On the other hand, **high income countries** are currently referred to as **advanced market economies**. Before, they were known as **developed countries**.

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