Geography revision guide

Chapter 1: population dynamics

Definitions:

1. Birth rate: the number of babies born each year per 1000 people.

2. Infant mortality: the number of children who die in their first year of life.

3. Fertility rate: the average number of children born per woman

4. Migration: the movement of people from one place to another.

5. Net migration= number of immigrants- number of emigrants

6. Population growth= natural change +net migration

7. Natural increase/ decrease= birth rate- death rate

8. Over-populated: there are too many people to be supported to a good standard of living by the resources of the country.

9. Under-populated: there are too few people to use all the resources of a country to maximum efficiency.

10. Population pyramids: are diagrams designed to show the population structure which is the composition of the population

Reasons for high birth rate

a. Cultural and social reasons

1. The number of children represents a man's prestige and standing in society, the more children he have, the greater is his prestige.

2. People have children to look after them in their old age in countries with poor care services and pension provision for the elderly.

3. Girls marry and start giving birth at a young age, so they give birth to more children in their life.

b. Religious reasons

1. Some religions oppose any form of contraception and encourage families to have children.

c. Economic reasons

1. People have children in their family because they want to provide labor for the family's farm or extra worker to boost the family's income.

2. Some countries especially in the rural areas, there are very few chance to get education, so people are unaware of contraception. Other people are too poor to buy contraceptives. Some countries are too poor to develop family planning clinics and subsidies contraception.

3. Some countries have high infant mortality, so people want to have many children to ensure that some survive into adulthood.

Reasons for falling death rates

1. The development of new medical knowledge, vaccines and medicines, better-trained doctors and greater access to clinics. Better treatment for typhoid, cholera and HIV/AIDS.

2. Increase access to clean water and proper sanitation improve people's health.

3. The spread of knowledge about better diet and a healthier lifestyle that is being helped by increase access to education.

4. Increase in access to food supplies.

Reasons for high death rates

1. Wars and natural disasters

2. Low standard of living, poor health and nutrition

3. Alcoholism and smoking increase rates of cancer.

4. Obesity resulting from a fast food diet increase incidences of heart disease.

Factors affecting population change

a. Changes to farming methods

If there are little technology for farming, then people often need large families to provide extra workers. As technology increases and countries develop, fewer people are employed in faring and the need for large families decrease.

b. Urbanization

As farming methods change and fewer people are needed to work on land, many rural people move to urban areas to work. They need fewer children there so they have smaller families.

c. Education and woman

As society and economy develop, women tend to stay in education longer, which means they get married start having children later and usually have fewer children as a result. Educated women also know more about birth control and so can limit their families more effectively.

Problems for rapid population growth

1. Slowing down countries (often developing and poorer countries) development

2. Food shortages: Countries will find it difficult to feed everyone, pressure on food supply, people become hungry.

3. Countries cannot afford to provide enough schools and teachers, so millions of people don't get the education and skills that would help to raise them out of poverty and help their countries to develop.

4. Countries cannot afford to provide good basic health care, with enough doctors and hospitals, so people will die from illness and disease.

5. Lack of clean water and sanitation.

6. Unemployment and under-employment.

7. Overcrowding

8. Traffic congestion

China's population policy (one-child policy)

In 1979, the Chinese government introduced rules to limit population growth--the one child policy. Couples who only had one child received financial rewards and welfare benefits such as giving preference access to housing, schools and health services and those who had more than one child were punished with fines on each additional child. There are also sanctions such as forced sterilization and pressure to abort pregnancy.

The positive influence of China's one child policy:

Population growth rate has fallen, the fertility rate decreased from 3 births per woman in 1980 to 1.5 in 2011 and there have been 250 million fewer births than there would have been.

Problems resulting from overpopulation have been reduced such as pressure on housing, healthcare, education, social services, waste disposal and less danger for epidemics spreading.

The negative impact of the one child policy

Social impacts

In future, more old people's home will be needed in China because it strict population control policy means that there are now too few young people being born to take care of all of their elderly relations.

Baby girls are often abandoned because Chinese social tradition prefer boys and it is estimated by 2020 that men will outnumber women by 30 million which will lead to social tension and unrest as men find themselves unable to get married.

Economic impacts

China's population is aging rapidly. About 22% of Shanghai's residents are over 60 and it is expected to rise to 34% by 2020. They all need supporting financial aid in their old age which includes need for expensive health care.

The dependency ratio is going to increase rapidly, from 10% in 2009 to 40

% by 2050. And from 2025, China is expected to have more elderly than children.

China's growing economy will not have enough workers in the future to keep it expanding, while also supporting the growing number of non-workers in the population.

Ageing populations

Reasons for ageing populations:

1. Increasing life expectancy: for example, the average life expectancy in Japan is 79 for men and 86 for women.

2. Low or even negative growth rate: some countries has low birth and population growth rates.

The consequences of ageing population

1. Some under-used and therefore uneconomical schools and colleges have had to be closed, so students have to travel further.

2. House prices in popular places may rise.

3. The cost of supporting older people through state pensions is increasing.

4. There will be greater demand on medical services and long-term nursing care. In many countries healthcare is paid for by taxation from working people.

5. A shortage of the recruits for the armed forces has weakened Japan's ability to defend itself.

6. A shortage of labor, especially innovative workers has caused countries' industries to stagnate. Therefore companies have had to increase their rates of pay to attract foreign workers.

Solutions to ageing populations

1. Raising the age of retirement so that older people work for longer and pensions are paid later.

2. Raising taxes on the working population to pay for care of the elderly.

3. Providing incentives to encourage people to have more children.

4. Encouraging immigration of young skilled adults to fill the gaps in the labour market.

Chapter 2: Migration

Glossary

**Migration:** The movement from one location to another location.

**Internal Migration:** Migration within a country e.g. Santa Ana to San Salvador or Birmingham to London.

**Rural-urban migration:** This is a type of internal migration. It is the movement of people from rural areas (the countryside) to urban areas (towns and cities).

**International Migration:** Migration between countries

**Temporary Migration:** Migration for a limited period, this might only be for a few weeks or even several years.  
**Permanent Migration:** Migration with the intention of staying forever.  
**Forced Migration:** When people are forced to migrate, often because their life is in danger.  
**Voluntary Migration:** When people freely choose to migrate usually for economic benefit

**Economic Migration:** Migration for work e.g. better salary or promotion  
**Seasonal Migration:** Migration just for a particular season e.g. the ski season or the harvesting season  
**Commuting:** Movement from home to workplace and vice versa.

**Emigrant:** A person who leaves a country to migrate to another.  
**Immigrant:** A migrant arriving in a new country.  
**Migration Balance:** The difference between emigrants and immigrants. If a country has more emigrants than immigrants that it is experiencing net migration loss. If a country has more immigrants than emigrants then it is experiencing net migration gain.

**Push Factor:** Things that are driving you from the location that you live e.g. crime and pollution  
**Pull Factor:** Things that are attracting you to a new location e.g. better job and nice weather.

**Refugees:** A person who has been forced to leave their home and their country. This might be because of a natural disaster, war, religious or political persecution.

**Asylum Seekers:** Someone who is trying to get refuge (residency) in a foreign country because their life is in danger in their home country. This is usually because of their political or religious beliefs.

**Intervening obstacles**: These are problems that a migrant may face on his journey.

Intervening obstacles may include:

(1) Shortage of money

(2) Language barriers

(3) Passport or visa issues

(4) Bad weather

(5) Transport delays

(6) Problems with housing

Impacts of Migration

Advantages to source country

(1) Reduced unemployment. El Salvador's is currently about 10%, but in reality it is probably much higher. There is also a lot of underemployment.

(2) Reduced pressure on schools and hospitals. It is estimated that there are 2 million migrants living in the US from El Salvador.

(3) Remittances sent by family and friends living abroad. Remittances go straight into the hands of the people, not the government. In 2010 it was estimated that El Salvador received $2.5 billion in remittances, shared between 22.5% of families.

(4) Improved relations with foreign countries e.g. El Salvador and US, in 2011 Barack Obama visited El Salvador

(5) Migrants may return home with new skills and knowledge of new technology

(6) Reduced birth and fertility rate and people in reproductive age range leave

Disadvantages to source country

(1) Often skilled and educated migrants leave 'Brain Drain'

(2) The dependency ratio increases as the economically active leave

(3) A dependency on remittances develops

(4) There may be shortage of workers, especially during harvests

(5) Family separation

Advantages to destination country

(1) Source of manual workers who are prepared to work dirty low paid jobs e.g. farming, construction and cleaning.

(2) Also source of skilled workers who are added to skilled workforce 'Brain Gain' e.g. teachers, nurses and lawyers (baseball players!)

(3) New cultures e.g. food and dance, Pupas as are sold in the US

(4) Improved links with source countries, possible new markets e.g. El Salvador buys US products and franchises e.g. Burger King and Starbucks.

Disadvantages to destination country

(1) Possible racial tension. US citizens will often blame Central Americans for taking their jobs.

(2) Inflation caused by increase demand

(3) Pressure on schools and hospitals. In parts of California over half of people speak Spanish, this can cause problems for schools, hospitals, etc.

(4) Possible unemployment

(5) Pressure on housing, electricity, water, etc.

(6) Increased congestion and pollution

Migrant workers

In countries where there is a low standard of living and a shortage of hobs, groups of people will migrate to nearby, wealthier countries hopping to find work. Many migrant workers, the majority of whom are likely to be men, may move with the intention of:

1. returning home after several years, having made their fortune such as Turks into Germany.

2. bringing their family to join them a later date

3. working seasonally at harvest times (e.g. Mexicans into California)

Chapter 3: Settlement

A settlement is a place where people live.

Settlements can be grouped together using a variety of criteria. These criteria include location (site and situation), shape (patterns), major use (function), and position, or rank, as a service center (hierarchy).

Site and situation

Site describes the point at which the town is located. Factors such as local relief, soil, water supply and resources were important in choosing the initial site of a settlement.

Situation describes where the settlement is located in relation to surrounding features such as other settlements, mountains, rivers, and communications. It is the situation of a settlement that determines whether or not it will continue to grow to become a large town or city or whether it remains as a small hamlet or village.

Settlement types

Urban (towns): 1. Conurbation or capital city

2. City

3. Large industrial town

Rural (Countryside):1. Small market town

2. Village

3. Hamlet

4. Isolated building

Patterns

1. Dispersed.

This can either be:

1. an isolated, individual building

2. A group of two or three buildings, perhaps forming a hamlet, and separated from the next group by two or three kilometers..

Dispersed settlement occurs in an area of adverse physical difficulty where natural resources are insufficient to support more than a few people. Traditionally, most buildings are farms although increasingly some are being use as second homes or for holidays.

2. Nucleated.

This is when several buildings were grouped together, initially often for defensive purposes and later for social and economic reasons. The nucleation of buildings into villages occurred when there was enough farmland for the inhabitants to be self-sufficient. Nucleated settlements often occur every 5 to 10 kilometers.

3. Linear or street.

Linear settlement occurs where buildings are strung out along a line of communication. This may be main road, a river valley or a canal or dyke.

Hierarchies

Hierarchy refers to the arrangement of settlements within a given area in an order of importance. Three different methods to determine the order of importance in the hierarchy have been based on:

1. the population size of a settlement.

2. the range and number of services provided by a settlement

3. the sphere of influence, or market area, of a settlement.

Glossary

1. Threshold population: is the minimum number of people needed to ensure that demand is great enough for a special service to be offered to the people living in that area.

2. Range: is the maximum distance that people are prepared to travel to obtain a service

3. Urbanization: means an increase in the proportion of people living in towns and cities.

Hierarchies

Hierarchy is based on:

1. the population size of a settlement

2. the range and number of services provided by a settlement

3. the sphere of influence, or market area, of a settlement.

1. Population size

2. Range and number of services

Villages provide a limited range and number of services. Services that do exist are those likely to be used daily (village shop) or which reduce the need to travel to other places (a primary school).

3. Sphere of influence

The sphere of influence, or market area, may be defined as the area served by a particular settlement. The area of the sphere of influence depends on the size and services of a town and its surrounding settlements, the transport facilities available and the level of competition from rival settlements.

Each settlement which provides a service is known as a central place. A central place provides goods and services for its own inhabitants and to people living in the surrounding area. The larger the settlement the more services it will provide and the more people it will serve. Large towns and cities will therefore have larger spheres of influence than smaller villages.

Change in time

Villages near to large cities tend to increase in size as they become more suburbanized. Villages in more isolated areas, in contrast, tend to lose population. This means that villages increasing in size are likely to gain additional or improved services (a large school, more shops) while villages declining in size will lose services.

Urban land use models

It was not until the rapid growth of industry in the nineteenth century that large-scale urbanization began in parts of Western Europe and northeastern USA. During the twentieth century, people continued to move to urban areas mainly for:

1. More and better-paid jobs

2. Nearness to places of work and entertainment

3. Better housing, services (schools and hospitals) and shopping facilities.

Urban land use models

A model is a theoretical framework which may not actually exist, but which helps to explain the reality. It has been suggested that towns do not grow in a haphazard way, but rather they tend to develop with recognizable shapes and patterns. Although each urban area is unique, it is likely to share certain generalized characteristics with other settlements.

1. Burgess claimed that in the center of all towns and cities there was central business district (CBD). He suggested, initially using Chicago as his example that towns grew outwards from this CBD in a concentric pattern. The resultant circles were based on the age of houses and the wealth of their occupants, with building becoming newer and the occupants more wealthy with increasing distance from the CBD.

2. Hoyt proposed his model after the development of public transport. He suggested that urban areas developed in sectors, or wedges, alongside main transport routes into and out of a city. He also claimed that if, for example, industry and low-cost housing developed in one part of a town in the nineteenth century, then newer industry and modern low-cost housing would locate in the same sector.

Urban land use and functional zones

Each of the zones has a function. The four main types of function are shops and offices, industry, housing, and open space. The location of each zone and the distribution of each functional zone are related to several factors.

1. Land values and space: Land values are highest and available sites more limited in the CBD where competition for land is greatest. As land, values decrease rapidly towards the urban boundary then both the amount of space and the number of available sites increase.

2. Age: As towns developed outwards, the oldest building were near to the city center (although many of these have now been replaced) and the newest ones in the outskirts.

3. Accessibility: The CBD, where the main routes from the suburbs and surrounding towns meet, has been the easiest place to reach from all parts of the city although this ease is now often reduced due to increased congestion.

4. Wealth of the inhabitants: The poorer members of the community tend to live in cheaper housing near to the CBD (with its shops) and the inner city (where most jobs used to be found). These people are less likely to be able to afford the higher transport (private or public) and housing coasts of places nearer the city boundary.

5. Change in demand: Land use and function change with time. For example:

1. nineteenth-century industry was located next to the CBD whereas modern industry prefers edge-of-city sites.

2. The main land use demand in the nineteenth century was for industry and low-cost housing. Today it is for industry, shops and better-quality housing, all in a more pleasant environment, and open space.

Industry

Inner city were characterized by large factories built during the Industrial Revolution.

They were located:

1. On the nearest available land to the town center and where there was enough space for large buildings

2. Next to canals and after the 1840s, railways which were needed to transport the heavy and bulky raw materials and the finished manufactured goods.

3. Besides rivers which, initially used as a source of power, provided water for washing and cooling and a means of disposing of waste

4. next to land that could be used to house the large number of workers who were needed.

Since then many factories have been forced to lose either due to a lack of space for expansion and modernization, or due to narrow, congested roads. Some factories, like the terraced housing, have been left empty, while other have been pulled down to leave large areas of derelict land.

Other types of land use

Inner cities also contained canals, railways and, later and leading to the CBD, main roads. They also included numerous corner shops. Corner shops served a small area, no more than a few streets, and were visited frequently by people needing everyday low-order, convenience goods; the shops opened for long, irregular hours and provided a social meeting place for local residents. Open space was extremely limited, partly because land near to the CBD was too expensive to leave unused and partly because few people had, due to long hours of work, spare time for recreation.

Traditional land use in suburbia and the rural-urban fringe

Compared with other places nearer the city center, this location has:

1. Less congestion and easier access, especially with other urban areas

2. A more attractive and less polluted environment

There is however, an increase in conflict between those who wish to see the economic development and extension of the urban area and those who wish to protect the rural environment that surrounds it.

Economic pressures from urban area

1. Suburbanized villages: homes for commuters who live here but work in the city. Restore old farm buildings. Build new estates.

2. New suburban hosing estate: large, often detached houses surrounded by big gardens. Lower land values and more cars allow 'urban sprawl’, which leads to low-density hosing but a rapid loss of farmland. Often ribbon or linear development along main roads.

3. Area of sewage work, landfill waste sites.

4. Regional shopping complex: hypermarket, hotel and office development.

5. Land for urban bypasses, national motorways and service station

6. Business and science parks with high-tech industries near to motorway interchanges.

Environmental pressures

1. Country park: near enough to city for use by urban dwellers. Reduces cost of getting to, and pressures on, national Parks. Urban dwellers want space for recreation, such as walking, ridding.

2. Conservationists want to protect wildlife habitats such as nature reserves.

3. Farmers wish to use and protect their farmland.

Residential environments in British cities

Cities are constantly changing. The residential types below were typical for the early 1980s. Since then, many old inner city areas either have been totally redeveloped or have undergone piecemeal improvements, while suburban areas have much more traffic and houses have been extended.

1. Old inner city area

The industrial revolution of the nineteenth century led to the growth of towns. The rapid influx of workers into these towns meant a big and immediate demand for cheap housing, and so builders constructed as many houses as possible in a small area, resulting in high-density housing with an overcrowded population. The houses were built in long, straight rows and in terraces. In those days of non-planning, few amenities were provided either in the house or around it.

2. Inner city redevelopment

When in the 1950s and 1960s vast bulldozers cleared areas of inner cities, many of the displaced inhabitants either moved to council estates near the city boundary, or were rehoused in huge high-rise tower blocks, which were created the sites of the old terraced houses. Although theses high-rise buildings contained most modern amenities, the apartments had to be reached by lifts, which led to narrow, dark corridors. Also despite the areas of greenery between the flats, there was still a very high housing density.

3. Suburbia

The rapid outward growth of cities began with the introduction of public transport, and accelerated with the popularity of the private car. This outward growth (also known as urban sprawl) led to the construction of numerous private, 'car-based' suburbs.

The houses built in the outer suburbs before the Second World War are characterized by their front and back gardens. Usually they have garages and are semi-detached with bay window. The recent estates have housing, which differs in both style and type, but they remain well planned and spacious.

4. Outer city council estate

As local councils cleared the worst of the slums from their inner city areas in the 1950s and 1960s, many residents were rehoused on large council estates on the fringes of the city. Attempts were made to vary the type and size of accommodation:

1. High-rise tower blocks, often 10-12 storeys high.

2. Low-rise tower blocks, usually 3-5 storeys high. These were built nearer the city boundaries, where there was more open space.

3. Single-storey terraces with some gardens and car parking space.

High cost of land

In the central areas, especially in the CBD districts of Middle and Downtown Manhattan, this has led to skyscraper development. High and values do mean, however, that only highly successful firm s can locate here such as large banks and giant oil-corporations. Many smaller companies have been forced out and even some of the larger ones are seeking less expensive and environmentally more attractive sites.

Urban decay

Many areas of inner city housing, such as Harlem, were built, as in Britain, in the late nineteenth century. The tenement blocks, flats and terraced housing suffered through years of neglect. Some of the worst areas became ghettos with few properties having modern amenities such as hot water, bathroom and WC. Most people rented their homes and if they could not afford the high rent, their houses became empty and vandalized. The ghettos became home for the very poorest families-ethnic minorities, the unskilled and the unemployed. They experienced overcrowding in terms of both the number of houses per square kilometer and number of people per house.

Immigrants

America has always welcomed large numbers of immigrants but has not always been able to offer them equal opportunities. Over a period, many immigrants find jobs and, as their wealth increases, are able to move away from the poorest areas, leaving them vacant for the next wave of immigrants. This process, known as centrifugal movement. Immigrants and poor families who cannot find work or only earn low wages may find themselves trapped in the so-called vicious circle of poverty. In 1990, estimates suggested that there were over 50000 homeless people in New York, most of them in Manhattan.

Traffic congestion

Each morning up to 2 million commuters, (people living outside Manhattan but working there) travel into the area. At night, the direction of movement is reversed. About 75 percent of commuters travel by public transport, mainly the underground, or 'subway'. Roads become blocked with cars, buses and yellow taxis. Although the rivers that surround Manhattan made it an ideal site for the first settlers, they now add to the congestion, especially where bridges, tunnels, and ferries cross them.

Unemployment

During the 1980s up to 1.5 million new Yorkers were unemployed. Unemployment was mainly due to a decline in the port, in associated port industries and, especially, in the clothing industry. New industries tend to be high-tech and in finance-hobs that require skills not possessed by many of the unemployed.

Crime

By the late 1980s, crime had become, arguably, the greatest single problem. Street violence, subway muggings, drug-related crimes and murder (on average, one every five hour) had turned certain parts of Manhattan into 'no-go' areas. Ethnic groups tended to congregate into their own small communities, and racial tension was high.

Pollution

New Yorkers has severe refuse collection and disposal problem. Vehicles cause air and noise pollution, while run-down houses and graffiti cause visual pollution.

Water supply

Water has to be pumped a distance of almost 200km.

Chapter 4: Plate tectonics

Glossary

1. Plates: Sections of the Earth's surface include the Earth's crust and the upper part of the mantle.

2. Fold mountains: they are long, relatively narrow belts of mountains, with parallel ridges and valleys. They are formed where the powerful compression of two tectonic plates squeezes the layers of rocks so that the unfolds form the ridges and the down folds form the valleys.

3. Volcanoes: A volcano is a hole or crack in the ground through which gases, lava and pyroclastic material are erupted. The vent is connected to a magma chamber beneath the ground.

4. Craters: are circular depressions that are usually less than 1 kilometer in diameter. It is formed by the explosive ejection of material from a central vent.

5. Calderas: A caldera is a huge crater caused when a volcanic cone collapses into a partly empty magma chamber after a powerful eruption.

6. Parasitic cones: These are smaller cones which develop on the sides of a bigger volcano. They form when the main vent becomes blocked and the magma finds another outlet.

**7. Vent:** A long tube or pipe that allows magma to escape to the surface.

Why do the plates move?

Heat is unevenly distributed within the Earth, so there are hotter areas and colder areas. At the hotter areas, the rocks in the Earth's mantle become lighter and rise and causing convection currents. These convection currents drag at the rigid plates sitting above them and causing them to move.

Plate boundaries

1. Destructive plate margins

Destructive margins are places where plates move toward each other. The oceanic plate is destroyed. The oceanic plate collides with a continental plate. Because the oceanic plate is denser, it is forced beneath the less dense and lighter continental plate. This process is known as subduction. The ocean floor is dragged down by this process to form a long and relatively narrow, but deep, ocean trench. A good example is the West coast of South America, beneath the Andes as the Nazca Plate collide with the South American Plate and form the Peru-Chile Trench.

As the oceanic plate is sub ducted beneath the continental plate, friction between the two plates causes earthquakes. Eventually, the oceanic plate is forced so deep into the Earth that it is partially melted, becomes part of the mantle and is destroyed. Partial melting of the sub ducted plate and the overlying mantle produces magma (molten rock ), which rises to form the volcanoes that occur in the Andes.

The powerful compression of the colliding plates also crumples the rocks of the continental plate and forces them up to form the fold mountain range of the Andes.

2. Collision plate margin

Collision plate margin is where two continental plates more towards each other, collide and are crushed against each other. They are pushed upwards forming new mountains because the two plates have equal weight so neither one can sink. Earthquakes are common but there are no volcanoes. For example, the Himalayas were caused by the collision of the Indian plate and the Eurasian Plate.

3. Constructive plate margin

Constructive plate margins are the places where new oceanic plate is created, the plates are moving apart and small pockets of magma slowly collect and rise towards the Earth's surface where they cool and solidify to form new oceanic crust. This new rock forms below as well as on the sea bed. The lava often flows out from long cracks. The oceanic crust cracks and diverges, pushed apart by the newly formed crust and dragged by the convection current in the mantle. A good example is the volcanic island of Iceland in the North Atlantic Ocean.

4. Conservative plate margins

Conservative plate margins are called because plates are neither being created nor destroyed. Shearing stress occurs at these margins and the plates slide past each other sideways. Friction between the two plates causes earthquake but volcanoes do not occur.

The San Andreas Fault system in California is an example of a conservative plate margin. The Pacific Plate is moving past the North American Plate with greater speed and shearing occurs.

Volcanoes

What comes out of a volcano?

1. Gases: The main gas to be emitted by volcanoes is water vapour but there may also be emissions of sulfur dioxide, hydrogen sulfide, nitrogen, hydrogen and carbon dioxide. Some of these gases are poisonous.

2. Liquids: Magma is molten rock material below the Earth's surface. Lava is the flows of molten rock material which have erupted onto the Earth's surface.

3. Solids: These are known as pyroclastic material.

1. Ash is made up of the smallest particles. However, blocks of the coarsest material are much larger.

2. The smallest particles can be held in suspension in the air, as clouds, for months or even years.

3. The particles get finer the further away they are from the volcanic vent. Because of its weight and size, the largest material is dropped nearest to the vent. More material is therefore found close to the vent than further away.

The dangers of volcanic eruptions

1. Ash falls: Fine ash is blasted into the atmosphere, where it can stay in suspension for many months, affecting areas far away from the volcano. It mostly damages property by burying buildings. Ash can also be a hazard to aircraft and lead to the cancellation of flights. Sometimes ash clouds can block the sun, causing the weather to be cooler and affecting crops.

2. Pyroclastic flows: Very hot material can travel rapidly down valleys and slopes. It is impossible for people to escape, so pyroclastic flows can be responsible for many deaths.

3. Mudflows (lahars): These form when ash mixes with water and travels down river valleys. Because mud is much denser than water, mudflows are very destructive-washing away buildings, roads, bridges and people.

4. Volcanic gases: Carbon dioxide is a dense, non-toxic gas that can flow downhill, causing suffocation. Other gases that are poisonous can burn or cause lung diseases.

5. Acid rain: Because of the sulfur dioxide and hydrogen sulfide released, very large eruptions cause acid rainfall. This can damage buildings, and may have had very serious effects on plant and animal species in the past.

6. Post-eruption famine and disease: The disruption to homes, roads and services caused by the effects can result in famine and disease, especially in LEDCs.

7. Lava flows: Although lava flows can destroy buildings, they rarely result in a direct loss of life-they travel slowly enough for you to walk away.

Advantages brought by volcanoes

1. Geothermal power: Rocks beneath the surface are very hot and water in the ground is hot. Electricity is generated, either directed from steam in volcanically active areas, or by water pumped down and heated from hot rocks. Hot water from the ground can be used directly in central heating systems and even in swimming pools. 87% of all Icelandic homes getting their heating and hot water from geothermal energy and 24% of the country's electricity is produced from geothermal energy.

2. Fertile soils: Some types of lava and ash weather rapidly in tropical conditions and form a rich, thick soil layer, abundant in trace elements. This soil can be extremely fertile and produce high crop yields.

3. Tourism: Safe volcanoes tend to attract tourists, this has helped the economy in places such as Iceland and the Canary Islands and creates jobs such tour guides and hotel workers.

4. Mineral and mining: Much of the sulfur is mined form around active volcanoes.

How volcanoes form?

1. Magma is produced deep within the Earth, in areas that are hotter than the melting point of the rocks. The magma rises because it is less dense than the surrounding solid rocks.

2. Magma often contains water dissolved within it as gas. As the magma rises, it may reach a depth where the pressure is lower. The dissolved gas can no longer be held in solution in the magma and it begins to form bubbles, which expand.

3. In runnier magma, the gas is able to escape. However, in thick viscous magmas, the gas is released explosively at the surface-producing very violent eruptions that spray lava high into the air.

4. Bubbles of liquid lava burst explosively in the air and then the material cools, solidifies, and falls to the ground. This is how the pyroclastic material is produced.

5. The build-up of this material leads to the formation of the volcano.

Earthquakes

Glossary

1. Focus: The point within the Earth where the earthquake originates.

2. Epicenter: The point on the Earth's surface directly above the focus.

Global distribution of earthquakes

The major earthquake zones are around the Pacific Ocean and in mountainous regions such as the Himalayas, central China and Iran

What causes earthquakes?

Earthquakes are caused by plate movements-either towards each other, away from each other or sliding past each other. The plates don't always move at a constant rate, they are often 'stuck' in one position. Stress and pressure builds up as the plates try to move. Then there is a sudden release of pressure when the plates break free( along a crack in the Earth called a fault). Huge amounts of energy are released and the shock waves or vibrations travel through the Earth as an earthquake wave or seismic wave.

Assessing earthquakes

Earthquakes can be assessed using the Richter Scale of magnitude, which measures the total amount of energy released by and earthquake. An increase of 1 on the scale means that the energy released increases by about 30 times.

The amount of damage that and earthquake causes will be affected by the following factors:

1. the amount of energy released(as measured by the Richter Scale)

2. the depth of the focus beneath the surface(shallower earthquakes have a greater effect)

3. the density of the population in the area of the earthquake epicenter

4. whether or not the buildings have been built to withstand earthquakes

5. how solid the bed rock is: weak sands and clays can turn to liquid(known as liquefaction), causing buildings to collapse.

Tsunami

A tsunami is a giant ocean wave that is generated by an earthquake when there is displacement (movement) of the seabed. The wave is magnified as it travels into shallower water. It becomes slower moving, more closely spaced and much, much higher. It can travel across whole oceans and can have devastating effects on coastal lowlands, especially when they are densely populated.

Chapter 5: Drainage basins and rivers

Glossary:

**Source:** The start of the river, normally found in mountainous areas.  
**Mouth:** The end of the river, this is normally where a river enters the sea, but it can be where it enters a lake.  
**Tributary:** A small river that flows into a bigger river  
**Confluence:** Where two rivers join/meet.  
**Estuary:** The section of the river near the mouth that is tidal.  
**Drainage basin (catchment area):** The area of land that drains into one river and its tributaries. A drainage basin is known as an open system because water can be added and lost.  
**Watershed:** The dividing line between two drainage basins.

**River Long Profile:** The long profile is the course the river takes from its source to its mouth. The long profile is often split into upper course and lower course (and sometimes middle course as well). The upper course is near the source and is normally found in mountainous areas. The lower course is near the mouth and on much flatter ground nearer sea level. Some rivers may have their mouth in lakes or wetland areas e.g. the Okavango in Botswana, but this is unusual.

**Bed:** the bottom of the river channel.  
**Bank:** The sides of the river channel. A river has two banks.  
**Wetted perimeter:** The length of the bed and the banks in contact with the river.  
**Channel:** The route course (between bed and banks) that a river flows. The flow of the river is often described as channel flow.

The drainage basin system

A drainage basin forms part of the hydrological cycle but unlike the hydrological cycle, it is an open system.

It is an open system because it has:

1. Inputs where water enters the system through precipitation (rain and snow)

2. Outputs where water is lost to the system either by rivers carrying it to the sea or through evapotranspiration, which is the loss of moisture directly from rivers or lakes (evaporation) or from vegetation (transpiration).

Within the system are stores and transfers (flows)

1. Stores are places where water is held such as in pools and lakes on the surface or in soil and rocks underground.

2. Transfers are processes by which water flows, or moves through the system such as infiltration, surface runoff , through flow

When it rains, most water droplets are intercepted by trees and plants. Interception is greatest in summer. If the rain falls as a short, light shower then little water will reach the ground. It will stored on leaves and then lost to the system through evaporation.

When the rain is heavier and lasts longer, water will drip from the vegetation onto the ground. At first, it may form pools (surface storage) but as the ground becomes increasingly wet and soft, it will begin to infiltrate. Infiltration is the downward movement of water through tiny pores in the soil. This downward transfer will be greatest in porous rock or soil such as chalk or sand, and least in impermeable rock or soil like granite or clay. The water either will then be stored in the soil or slowly transferred sideways or downwards. The movement of water sideways is called through flow and it is likely to form, eventually, a spring on a valley side. When the movement of water is downwards, it is called percolation. Percolation forms groundwater, which is water stored at a depth in rocks. Groundwater flow is the slowest form of water transfer. The fastest process of water movement is surface runoff. Surface runoff, sometimes referred to as overland flow, occurs when either the storm is too heavy for water to infiltrate into the soil, where the soil has become saturated. The level of saturation such as when all the pores have been filled with water is known as the water table. Although some rain may fall directly into the river, most water reaches it by a combination of surface runoff, through flow and groundwater flow. Rivers carry water to the sea where it is lost to the system.

River processes

Transportation

**Traction:** The process of large pieces of load rolling along a riverbed.  
**Saltation:** The process of load bouncing along a riverbed.  
**Suspension:** The process of smaller pieces of load being carried in a rivers flow.  
**Solution:** The processed of dissolved pieces of material being transported in a solution.  
Sometimes a fifth form of transportation is also mentioned; flotation.

Erosion

**Corrasion (abrasion):** The process of a rivers' load crashing and rubbing into a rivers' banks and bed causing pieces to break off.  
**Corrosion (solution):** The process of water dissolving a rivers' load as well as its bed and banks.  
**Hydraulic action:** Water and air getting into cracks in a rivers banks and bed causing erosion through increased pressure.  
**Attrition:** Load crashing into each other in a river. This normally happens with suspended load.  
Remember in the upper course near the source there is more **vertical erosion** and in the lower course near the mouth, there is more **horizontal (lateral) erosion.**  
This is because near the source a rivers' load is bigger, more angular, and therefore less likely to be suspended in a rivers flow. Instead, it will bounce and crash into the bed, causing vertical erosion. However, nearer the mouth load is smaller and smoother and therefore more likely to be suspended and therefore more likely to crash in the banks, causing horizontal erosion.  
Because of erosion, a rivers' load tends to get smaller and smoother as you move from the source to the mouth.

Deposition

Deposition occurs when a river lacks enough energy to carry its load. Deposition, beginning with the heaviest material first, can occur following a dry spell when the discharge and velocity of the river drop, or where the current slows down (the inside of a meander bend or where the river enters the sea).

River landforms in a highland area

V-shaped valleys and interlocking spurs

Any spare energy possessed by a river near to its source will be used to transport large boulders along its bed. These results in the river cutting rapidly downwards, a process called vertical erosion. Vertical erosion leads to the development of steep-sided, narrow valleys shaped like the letter V. The valley sides are steep due to soil and loose rock being washed downhill following periods of heavy rainfall. The material is then added to the load of the river. The river itself is forced to wind its way around protruding hillsides. These hillsides, known as interlocking spurs, restrict the view up or down the valley.

Waterfalls and rapids

Waterfalls form when there is a sudden interruption in the course of a river. They may result from erosion by ice, changes in sea level, and earth movements. However, many waterfalls form when rivers meet a band of softer, less resistant rock after flowing over a relatively hard, resistant rock. The underlying softer rock is worn away more quickly, and the harder rock is undercut. In time, the overlying harder rock will become unsupported and will collapse. After its collapse, some of the rock will be swirled around by the river, especially during times of high discharge, to form a deep plunge pool. This process is likely to be repeated many times, causing the waterfall to retreat upstream and leaving a steep-sided gorge. Rapids occur where the layers of hard and soft rock are very thin, and so no obvious break of slope develops as in a waterfall.

River landforms in a lowland area

Meanders and ox-bow lakes

As a river approaches its mouth it usually flows over flatter land and develops, increasingly large bends known as meanders. Meanders constantly change their shape and position. When a river reaches a meander, most water directed towards the outside of the bend. This reduces friction and increases the velocity of the river at this point. The river therefore has more energy to transport material in suspension. This material will erode the outside bank by corrasion. The bank will be undercut, collapse and retreat to leave a small river cliff. The river is now eroding through lateral, not vertical, erosion.

Meanwhile, as there is less water on the inside of the bend, there is also an increase in friction and a decrease in velocity. As the river loses energy, it begins to deposit some of its load. The deposited material builds up to form a gently sloping slip-off slope.

Continual erosion on the outside bends results in the neck of the meander getting narrower until, usually at a time of flood, the river cuts through the neck and shortens it course. The fastest current will now be flowing in the center of the channel and deposition is more likely next to the banks. The original meander will be locked off to leave a crescent-shaped ox-bow lake. This lake will slowly dry up, except during periods of heavy rain.

Glossary

Coast: it is the border between land and sea.

Introduction of the coast

(1) The sea rises to high tide and falls to low tide normally twice a day. This results in the high and low water marks.

(2) The coastline follows the mean high water mark on a lowland coast, and the foot of cliffs on a steeply sloping coast.

(3) The area between the lowest tide level and the highest point reached by storm waves is known as the shore.

Waves

**Crest:** The top of the wave.  
**Trough:** The low area in between two waves.  
**Wavelength:** The distance between two crests or two troughs.  
**Wave height:** The distance between the crest and the trough.  
**Wave Frequency:** The number of waves per minute.  
**Velocity:** The speed that a wave is traveling. It is influenced by the wind, fetch and depth of water.  
**Swash:** The movement of water and load up the beach.  
**Backwash:** The movement of water and load back down the beach.

Waves result from friction between the wind and the surface of the sea. This causes part of the sea to rise at right angles to the wind. The wave form increases in height as it is driven forward by the wind.

The size of a wave depends on:

(1) the wind speed

(2) the length of time during which the wind blows in the same direction

(3) The length of sea over which the wind blows (the fetch of the wave).

The effect on waves of entering shallow water

(1) Out at sea, the wind tugs at the surface of the water, causing the wave shape to move.

(2) When a wave moves into shallow water near the coast, it is distorted until it breaks.

(3) From this moment on, the water moves forward.

(4) Water rushes up the beach-this is called the swash.

(5) And then it drains back down the beach this is called the backwash.

Destructive waves

Waves that have a weak swash and a strong backwash pull sand and pebbles back down the beach when the water retreats. They are called destructive waves, because they remove material from the beach. They are often steep, high waves that are close together and crash down on to the beach. If you were counting them, they would be coming in very quickly 10 to 15 every minute.

Constructive waves

Waves that have a very strong swash and a weak backwash are known as constructive waves, because they build up the beach. They push sand and pebbles up the beach and leave them behind when the water retreats, because the backwash is not strong enough to remove them. They are often low waves with a longer time between them. They come in at a rate of 6-8 every minute.

Marine erosion

The effects of attrition are increased the further the distance and the longer the period over which material is moved by the waves. An angular boulder will eventually be broken down into small, round grains of sand, which are very resistant to further breakdown. Rounded beach material of intermediate size between boulders and sand is known as shingle.

(1) Hydraulic action: Water is forced into cracks in the rock. This compresses the air inside. When the wave retreats, the compressed air blasts out. It can force the rock apart.

(2) Attrition: Loose sediment knocked off the cliff by hydraulic action and abrasion is swirled around by the waves. It constantly collides with other sediment, and gradually gets worn down into smaller and rounder sediment.

(3) Corrasion: Loose rocks, called sediment, are thrown against the cliff by waves. Out wears the cliff away and chips bits of rock off.

(4) Corrosion: This happens when seawater dissolves material from the rock. It happens along limestone and chalk coasts, when calcium carbonate is dissolved.

Marine transportation

(1) Suspension: Fine sediments is carried as a suspension in the water, making it look muddy or murky.

(2) Traction: Large pebbles and cobbles are rolled along the seabed.

(3) Solution: Dissolved material is carried along in solution, so you cannot see it.

(4) Saltation: small pebbles are moved when one pebble hit another, causing it to bounce. This bouncing can set up a chain reaction.

As well as being moved up and down a beach, sediment can also be moved along it-if the incoming waves are driven by onshore winds at an oblique angle to the coast. This movement of sediment along a beach is called longshore drift.

On coasts where longshore drift occurs mainly in one direction, beach sediment is transported further down the coast. If an obstruction prevents its replacement from further up the coast, the beach will be depleted. This causes two problems for the local authorities:

(1 The smaller beach is less attractive to tourists, causing a loss of income.

(2) It removes the protection from erosion that the beach provides for cliffs.

To counter this, some local authorities put barriers called grayness at right angles to the beach - to trap the sediment and reduce longshore drift.

Material may also be moved along some coasts in the offshore zone by longshore current. These are like rivers of water moving through the sea along the coast.

Marine deposition

(1) When the strong swash of a constructive wave moves up a beach, it carries sand or shingle with it.

(2) The largest material is deposited at the upper limit reached by the swash.

(3) The backwash then carries smaller material back down the beach - it progressively loses water, and therefore energy, as it does so. This is because a beach is very porous - water passes down through spaces between the individual beach particles. The flow of the backwash is weakened as a result., until it can only carry the lightest material.

(4) Consequently, as the backwash weakens as it flows back towards the sea and gets weaker, it deposits shingle and sand particles of progressively smaller size.

(5) The material on a beach is, therefore, sorted by wave deposition - the largest shingle is deposited at the top of the beach and the finest sand is deposited near the sea. The smallest mud particles settle in the low-energy environment offshore.

(6) When a storm occurs at the time of the highest tides, large shingle is tossed above the usual high tide level to form a ridge at the top of the beach.

Landforms formed by marine erosion

Cliffs are vertical or steeply sloping rocks. The angle of their slope depends on the nature of the rocks that form them, and also the amount and ferocity of wave attack at their bases. Many cliffs have an indentation - called a wave-cut notch - at about the high-tide level, where wave attack has undercut the rock.

Waves continue to attack the base of the cliff until the rock above becomes unsupported and collapses. This process continues and the cliff is steadily worn back. The retreat of the cliff leaves a wave-cut platform where the cliff once stood.

Wave-cut platforms extend between the low-water mark and the cliff base at the high-water mark. They slope gently towards the sea and may have rock pools eroded into them at weak points. These solid rock platforms are often covered with debris eroded from the cliffs.

The profile of a cliff varies according to the nature and dip of the rocks which form it.

Headlands and bays

Coastline with alternate hard and soft rocks consist of a series of headlands and bays,

A headland:

Projects out into the sea

is usually longer than its breadth

has sides which form cliffs.

A bay usually has:

an approximately semi-circular shape of sea extending into the land

a wide, open entrance form the sea

land behind it that is lower than the headlands on either side.

Headlands and bays form most readily on discordant coasts, where different types of rock lie at right angles to the sea and are subjected to differential erosion. The soft rocks are more easily eroded than the hard rocks, so they are worn back more quickly to form bays. The hard rocks resist erosion and form headlands, which protrude out into the sea between the bays.

Caves, arches and stacks

As oblique waves enter shallow water, they tend to turn so that their crests are parallel to the coast. This is known as wave refraction. Waves can be seen refracting around the headland and bay.

This refraction concentrates wave attack on all sides of the headland. Any line of weakness in the rocks is then subjected to hydraulic action and corrasion - forming caves and narrow inlets and, eventually, arches and stacks.

If the rock contains soluble minerals, corrosion will also weaken the rock.

Arches and stacks are most common on discordant coasts. They are rarer on concordant coasts, where the rock layers are parallel to the sea.

How caves, arches and stacks form?

1. a joint or fault in resistant rock.

2. Corrosion and hydraulic action widen the joint to form caves on either side of the headland.

3. The caves are eroded until they cut completely through the headland and meet to form an arch.

4. The arch is eroded and the roof becomes too heavy and collapses.

5. This leaves a tall stack.

6. The stack continues to be eroded and collapses.

Landforms of coastal deposition

Beaches

Beaches are composed of sand or shingle, or both. When both sediments are present, the shingle forms a steep slope at the highest parts of the beach and the sand a getle slope on the lower parts. On a purely sand beach, the coarse sand will be at the top and the finest particles will be by the sea.

All beach material has been eroded from further along the coast and then transported by longshore drift. Often sand is deposited in the relatively calm waters of a bay, or at the head of an inlet.

some beaches are remarkably straight.

Spit and bars

Straight coasts differ from bays in having straight beaches. They can be made of either sand or shingle, which has been moved along the coast by longshore drift from the area where the sediment was eroded. The material is deposited where the coast changes direction, at a river mouth or bay. As deposition continues it builds up and the beach continues to grow out across the bay or river mouth to form a spit. This landform is a long, narrow, ridge of sand or shingle, with one end attached to the land and the other ending in open water.

Some spits become curved at their ends. This happens when onshore winds blow waves from a different angle to that of the prevailing wind. If the spit then grows in the original direction again, it will have a hooked form.

The river's flow is preventing the spit from extending out to join the other bank. However, if a spit grows out across a bay, it can sometimes reach right across to the other side - forming a bar. The area of water enclosed by the bar is called a lagoon. At first, it contains salt water but that is replaced with freshwater if river enter it. The lagoon will be a temporary feature if rivers continue to deposit their load into it and gradually fill it up to form a marsh. If a river enters a lagoon, it replaces the salt water with fresh water.

Chapter 7: Weather

Glossary:

1. Weather: is the hour-to-hour, day-to-day state of the atmosphere. It includes temperature, sunshine, cloud cover, precipitation, atmospheric pressure, wind speed and wind direction. It is short-term and can be localized in relatively small areas.

2. Climate: is the average weather conditions of a place taken over a period of time, often 30 years. It is the expected, rather than the actual, conditions. It is long-term and is often applied to sizeable parts of the globe such as the equatorial and the Mediterranean climates.

Cloud types

Clouds  
Clouds are a collection of water droplets or ice crystals. The warmer the air temperature, the more water vapor (gas) that the air can hold. However, when the air starts to cool, water vapor starts to condense as long as it has condensation nuclei to condense around.  
Cirrus

1. Found high in the atmosphere – usually over 5,500 meters

2. Common throughout the world

3. Thin and wispy in appearance

4. Move quickly  
Stratus

1. Low level – below 2000m and sometimes reaching ground.

2. Usually grey and color and move fast.

3. Can produce light rain and snow.  
Cumulonimbus

1. Large clouds up to 10km high and across.

2. They resemble giant cauliflower.

3. Produce rain, thunder and lightening

4. Usually found in spring and summer  
Cumulus

1. Fairly low clouds with bottom between 600m and 1200m

2. Look like lumps of cotton wool

3. Can produce light rain

4. Individual clouds have a short life cycle

Rainfall

Types of rainfall

There are three main types of rainfall: relief, frontal and convectional. In all three cases rainfall results from warm air, which contains water vapour, being forced to rise until it cools sufficiently for condensation to take place. Condensation can only occur when two conditions are met:

1. Cold air cannot hold as much moisture as warm air. As the warm air and water vapor rises, it cools until a critical temperature is reached, at which point the air becomes saturated. this critical temperature is called dew point. if air continues to rise and cool, some of the water vapor in it condenses back into minute droplets of water.

2. Condensation requires the presence of large numbers of microscopic particles known as hygroscopic nuclei. this is because condensation can only take place on solid surfaces such as volcanic dust, salt or smoke.

The difference between the three types of rainfall is the condition that forces the warm air to rise in the first place.

1. Relief rainfall

Relief rain occurs when warm, almost saturated air from the sea is blown inland by the wind. Where there is a coastal mountain barrier, the air will be forced to rise over it. The rising air will cool and, if dew point is reached, condensation will take place. once over the mountains the air will descend, warm and, therefore, the rain is likely to stop. The protected side of a mountain range is the rain shadow. In Britain the prevailing winds come from the south-west, collecting moisture as they cross the Atlantic ocean. They bring heavy rainfall to Western parts as they cross the mountains of Scotland, Wales and northern England. Eastern areas receive much less rain as they are in the rain shadow area. Places like Fort William and Penance get heavy rainfall in later autumn when the sea is at its warmest, and winds blowing over it can pick up most moisture.

2. Frontal rainfall

Frontal rain is associated with depressions and results from warm, moist air from the tropics meeting colder, drier air form polar areas. As the two air masses have different densities, they cannot merge. Instead the warmer, moister and lighter air forced to rise over the colder, denser air, setting the condensation process into motion. The boundary between the warm and cold air is called a front. Most depressions have two front, a warm and a cold front, giving two periods of rainfall. Britain receives many depressions and their associated fronts each year. Depressions usually come from the Atlantic Ocean, increasing rainfall on the west coasts. Depressions are more common in winter, as illustrated by the winter rainfall maximum.

3. Convectional rainfall

Convectional rain occurs where the ground surface is heated by the sun. As the air adjacent tot he ground is heated, it expands and begins to rise. if the ground surface is wet and heavily vegetated, as in equatorial areas, there will be rapid evaporation. As the air rises, it cools and water vapor condenses to form towering cumulonimbus clouds and, later, heavy thunderstorms. Equatorial areas, where the sun is constantly at a high angle in the sky, experience convectional storms most afternoons. Convectional rain is less frequent in cooler Britain, and is most likely in south-east England in summer when temperatures are at their highest. This also accounts for the summer rainfall maximum in this region.

Tropical cyclones (hurricanes)

Formation

Tropical cyclones are areas of intense low pressure known locally as hurricanes, typhoons or cyclones

Hurricanes tend to develop:

1. over warm tropical oceans, where sea temperatures exceed 27°C over a vast area, and where there is a considerable depth of warm water

2. in later summer and early autumn, when sea temperatures are at their highest

3. in the trade wind belt between latitude 5° and 20° north and south of the Equator.

Although their formation is not yet fully understood, they appear to originate when a strong vertical movement of air draws with it water vapor from the ocean below. As the air rises, in a spiral movement, it cools and condenses - a process that releases enormous amounts of heat energy. (It has been estimated that the heat energy released in a single day in a hurricane is equivalent to 500000 atomic bombs the size of those dropped on Japan during the Second World War) It is this heat energy that powers the storm and which must be maintained if the hurricane is to move westwards on a course that is usually erratic and difficult to predict. In time and area of colder air sinks downwards through the center of the hurricane to form a central eye. Once the hurricane reaches land, and its source of heat energy and moisture is removed, it rapidly decreases in strength. Its average lifespan is 7 to 14 days.

Effects

Hurricanes, and other tropical storms are a major hazard that can cause considerable loss of life and damage to property and to a country's economy.

1. Winds often exceed 160km/hrs. (and can reach 250km/hrs.). In LEDCs, ,many of which lie in the tropical cyclone belt, whole villages may be destroyed and even in MEDCs, where people have money to reinforce buildings, houses and coastal developments can be severely damaged. High winds uproot trees and disrupt telephone and electricity power supplies. Worst hit are those LEDCs that have their only export crop destroyed.

2. Flooding caused by the torrential rain, is often the major cause of death. It can also pollute water supplies increasing the risk of cholera.

3. Storm (tidal) surges up to 5m and heightened by storm waves, flood low-lying coastal areas causing loss of life such as Bangladesh and blocking escape and relief roads.

4. Landslides occur where heavy rainfall washes away buildings erected on steep, unstable slopes.

The effects of acid rain

1. The acidity of lakes has increased. Large concentrations kill fish and plant life.

2. An increase in the acidity of soils reduces the number of crops that can be grown.

3. Forests are being destroyed as important nutrients (calcium and potassium) are washed away (leached). These are replaced by manganese and aluminum, which are harmful to root growth. In time, the trees become less resistant to drought, frost and disease, and shed their needles.

4. Water supplies are more acidic and this could become a future health hazard. For example, the release of extra aluminum has been linked to Alzheimer's disease.

5. Buildings are being eroded by chemical action caused by acid rain. The Acropolis in Athens and the Taj Mahal in India have both deteriorated rapidly in recent years.