Edexcel B

GCSE GEOGRAPHY

Revision Guide

2017/18

Paper		Additional Information about exam
Paper 1: Global Geographical Issues	**Topic 1: Hazardous Earth** – an understanding of the global circulation of the atmosphere and changing climate. Plus two depth studies of an extreme weather hazard (tropical cyclones) and tectonic hazards at contrasting locations. **Topic 2: Development dynamics** – an understanding of the scale of global inequality. Plus a depth study of how one emerging country is developing and the consequences for people, environment and the country's relationship with the wider world **Topic 3: Challenges of an urbanising world** – an overview of the causes and challenges of rapid urbanisation across the world. Plus one depth study of a megacity in a developing or emerging country.	Written examination: 1 hour and 30 minutes 37.5% of the qualification 94 mark Date of exam 22-May-18 PM
Paper 2: UK Geographical Issues	**Topic 4: The UK's evolving physical landscape** - an overview of the varied physical landscapes in the UK resulting from geology, geomorphic processes and human activity over time. Plus two depth studies of distinctive landscapes – Coastal change and conflict and River processes and pressures **Topic 5: The UK's evolving human landscape** - an overview of the changing and varied human landscape of the UK, including the socio-economic and political processes that influence it. Plus a case study of a major UK city – London **Topic 6: Geographical investigations** - two investigations, including fieldwork and research, carried out in contrasting environments, River processes and pressures' and 'Dynamic urban areas'.	Written examination: 1 hour and 30 minutes 37.5% of the qualification 94 mark Date of exam 5-June-18 PM
Paper 3: People and Environment Issues – Making Geographical Decisions	**Topic 7: People and the biosphere** – an overview of the global distribution and characteristics of large-scale ecosystems, why the biosphere is important to human wellbeing and how humans use and modify it in order to obtain resources **Topic 8: Forests under threat** – a detailed study of tropical rainforests and the taiga, looking at processes and interactions and issues related to their biodiversity and to their sustainable use and management **Topic 9: Consuming energy resources** – a study of renewable and non-renewable energy, its supply and demand, access and energy security issues, its sustainable use and management	Written examination: 1 hour and 30 minutes 25% of the qualification 64 marks Date of exam 11-June-18 PM

Geography GCSE Revision

You should:

- Get organised – plan a revision timetable for each week between now and the exams. Little & often is better than last minute cramming.
- Attend all lessons with the correct equipment and ready to work!
- Fill in the **revision pages & glossary** in this booklet. Use your **revision guides** and **lesson notes** to help you.
- Attend **Intervention**
- Use your revision guide, work book, past papers and **revision websites** such as **BBC Bitesize, GCSEpod.com** & **www.geographypods.com**.

Nearer the exams:

- **Plan your time** carefully and don't leave it all to the last minute. You cannot learn everything the weekend before the exam!
- Use the **A3 knowledge organisers** you created for each Topic.
- Learn a few **key facts and terminology** about each Topic. Postcards are good for this.
- Learn **place specific detail** for each case study.

On the exam days:

- Get a good night's sleep and eat a **healthy** breakfast and lunch.

The exams themselves:

- Have a last quick look through your revision notes beforehand.
- Arrive on time with the **correct equipment**: pen, spare pen, pencil, ruler, highlighter, and calculator.
- Write your name on the paper (this might seem obvious!).
- **Read the instructions** on the front cover carefully.
- **Highlight** key words in the question and make sure you obey the **command words**

e.g. **describe** = say what you see, **explain** = say why (*PEEL, because.., so what?*), **assess/evaluate** = weigh up using evidence

- **Watch the time** – remember you need to leave plenty of time for 8-16 mark questions. Plan your answers to these questions carefully.
- If you're not sure of an answer or running out of time then try to **write something**.

- Remember to use **P.E.E.L** for explaining.
- Don't forget the **SPAG** marks attached to an **8 mark Q** on Papers 1 & 2 & the **16 mark Q** on Paper 3, so get your **terminology** into those answers.
- If you have time check through your answers at the end.

GOOD LUCK

Command words made easy

Describe = say what you see! If there is a **resource** then quote facts and figures from it. If it's a map refer to the key, use compass directions (N, S, E, W), name places from the map, note any patterns (clustered, dispersed, linear?) or anomalies.

Explain = say why. Give reasons for your answer. Use ***because, so, therefore*.** A **4 mark** explain question will usually expect you to give 2 reasons for something. Make sure you give a clear reason, explain it, then give a 2nd **different** reason & explain it.

Assess = weigh up the importance of something. You should aim to write **two paragraphs** – sometimes the split is obvious in the question (costs & benefits, local & global impacts etc.) but sometimes you have to work it out. Consider the different factors and write clear **PEEL** statements. Can you include points about **Social, Economic and Environmental** if relevant?

On **Paper 1** you will have to write about named examples you have studied so put in plenty of **place specific detail.** On **Papers 2 & 3** you will have to assess evidence you are given so include **facts & figures** from the resource!

Finish your answer with '**I consider the most important factor to be…**'

Evaluate = weigh up **two sides of an issue**. Review the information using clear **PEEL** statements. If you are told to evaluate evidence you are given you must include **facts & figures** from the resource! If it is asking for your own knowledge then include **place specific detail** from named examples you have studied.

Evaluate questions must have a **conclusion**! Finish your answer with **'In conclusion the evidence suggests….'** and comment on any strengths, weaknesses and alternatives to the evidence.

Select & justify (the 16 mark Q on Paper 3) = select an option from the choice given. **Justify** your choice - you should write at least **two paragraphs** explaining why it is the best/most sustainable option. Use **evidence** from all of the Resources and your own knowledge to support your **PEEL** statements. Can you include points about **Social, Economic and Environmental**?

You should also include a paragraph explaining any **disadvantages** of your chosen option & a paragraph for **each option you rejected** giving their drawbacks.

HOW TO REVISE IN GEOGRAPHY

Self-assessment

Start your revision with a self-assessment of what you already confidently know, what you need to review and what you need to cover again.

Section C: Physical landscapes in the UK Part A - Coasts			RAG	
Content	**Key words / skills**	**Case Studies & examples**	**Before**	**After**
Key idea: The coast is shaped by a number of physical processes.				
1. Waves	Wave types characteristics.			
2. Coastal Processes	Weathering, mechanical, chemical, mass movement, sliding, slumping, rock falls, erosion, hydraulic power, abrasion, attrition, transportation, longshore drift, deposition, sediment			
Key idea: Distinctive coastal landforms are the result of rock type, structure and physical processes.				
3. Landforms - erosion	geological structure, rock type, characteristics, formation, erosion, headlands and bays, cliffs and wave cut platforms, caves, arches and stacks.	Example of a coastline in the UK		
4. Landforms - deposition	characteristics, formation, deposition, beaches, sand dunes, spits and bars.			
PPQ 1				
Key idea: Different management strategies can be used to protect coastlines from the effects of physical processes.				
5. Management	Costs, benefits, management strategies, hard engineering – sea walls, rock armour, gabions and groynes, soft engineering – beach nourishment and reprofiling, dune regeneration, managed retreat – coastal realignment.	Example of a coastal management scheme in the UK		
6. Case study	• the reasons for management • the management strategy • the resulting effects and conflicts			
PPQ 2				

LINKS: Edexcel B Geography 2017

How to use in Geography

Use the specification to review your learning for each topic.

As you plan your revision prioritise the weakest content first. Thus ensuring you focus on the content you struggled with first.

Be Organised

Distributed revision and interleaving of topics (switching between topics) is proven to have high impact on memory

Create yourself a revision plan, not just for Geography, include all of your subjects.

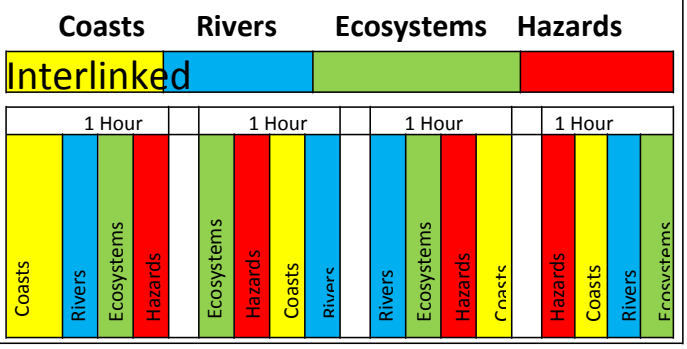
Mon	Tues	Wed	Thurs	Fri
Geog	Textiles	English Lit	English Lan	Comp Sci
Maths	French	Bio	Chem	Phys

Then break down the subject into topics, try interleaving the topics so you switch between topics rather than blocking each topic and not coming back to it for some time.

GetRevising
learn together

How to use in Geography

Break the papers into topic blocks. Rather than covering each topic once and moving onto the next try to interlinking them like below.



Chunked Revision

Try not to revise all topics in one go. Break topics up into chunks.

Chunking
Try spending just 15 minutes at a time on each topic 'chunk', after which move onto a different topic 'chunk' for another 15 minutes. Repeat over a one-hour period.

You can later self-test using one of the following methods.

How to use in Geography

Prioritise those you feel least confident with. Revise these for 15-minute chunks (4 chunks = 1 hour).

Create a quiz using your revision notes. Complete the quiz several days later. Dependent on how well you do, either add the topic to your next revision session or store your notes for future revision.

Flash cards

Probably the simplest of methods to help you to recall knowledge.

Create cards with questions on one side and answers on the other. You may choose to colour code your cards based on topic or content.

For example, you may want to make all of the cards associated with physical processes blue, case study content yellow, key terms green and so on.

You may want to try using the Leitner Method, which involves spaced repetition. You can find more information on the method in the video here.

Quizlet tinycards by duolingo

How to use in Geography

Key Terms – test your knowledge of definitions and examples
Case Studies – revise the facts, stats and specifics
Processes – draw a diagram and write a description
Narrative – create to show the formation of landforms, order of events, such as the cause, consequence and response to hazards **Command terms** – command term and description

Revision Clock

This method involves you breaking your topic down over a 1 hour period.

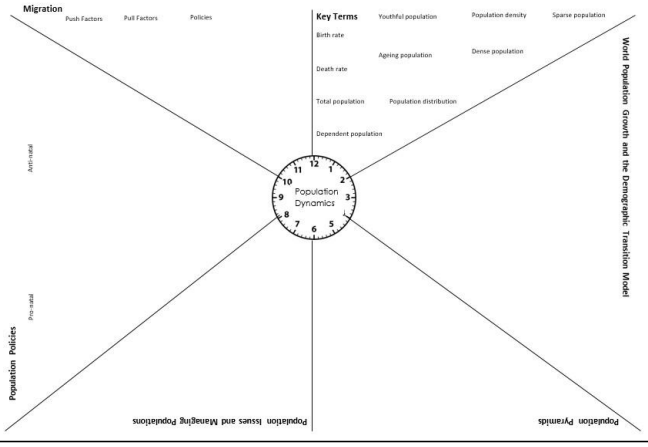
You'll need an A3 sheet and a clock image in the centre.

Split the sheet into 5 or 10-minute chunks. Give

each section a focus from the topic.

Spend no longer than the time designated to each section on that part of the topic.

How to use in Geography



Visual Revision

This method involves you transforming your notes into a visual format.
Whether this be putting the subject content into a graphic organiser such as a Venn diagram, a mind map, chain diagram, infographic or a sequential thinking model, the key idea is to make it visual to allow you to draw links between stages, content and images.

When you have the same information in words and visuals it gives you two ways of remembering the information later on.

popplet

How to use in Geography

Venn diagrams - compare and contrast *e.g. consequences of a hazard in an LIC/NEE and HIC*
Flow or chain diagram – outline a process or sequence *e.g. formation of a landform, cause and consequences of an event*
Mind Map – organise and link content
Infographic – use to summarise key points *e.g. case study facts, stat and specifics*
Storyboard – narrative *e.g. cause and consequence of an event, factors influencing migration etc.*

Retrieval Practice

This method involves testing what you know. The effort to remember something helps to strengthen your memory.

- ➢ Create quizzes to test yourself and your friends. Types of quizzes may include multiple choice, true or false or odd one out.
- ➢ Try writing down all that you remember on a topic before reviewing your notes.

memrise
Grow your mind

Quizlet
Kahoot!

How to use in Geography

Spaced - Test on old and new subject content **Must know -** Use to create '*must know*' quizzes **Examples –** *'Give two examples of…'*
Case studies – *'identify the cause of…', '2*

Elaborate Integration

This method involves you looking at the bigger picture of your learning in order to ask why. As you review content, come up with questions that you could try to prove as true. Then answer them either verbally with friends or write it down as a mind map.

This will require you to try to think about how information is related to the central idea. Therefore, rather than trying to learn individual facts and ideas you think about the concept or idea on a much larger scale.

How to use in Geography

Take a question or concept from the exam specification and write it down.
e.g. Globalisation is unstoppable.
Write down how you can prove this as true but also consider the counterargument.

Review. Practice. Check.

This method requires you to make use of exam style questions, whether they be past paper questions, sample paper questions or exam style questions created by your teacher.

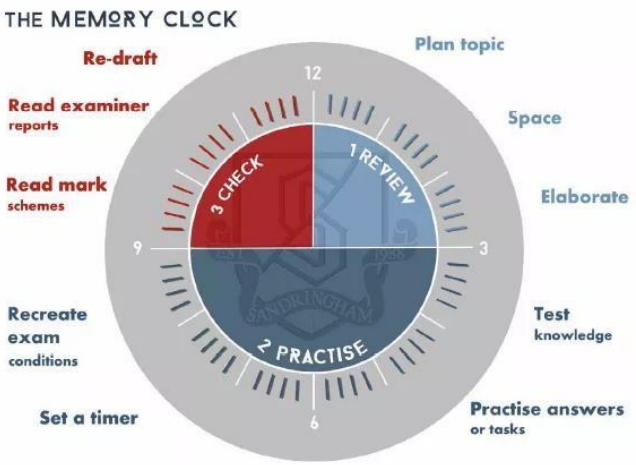
Start by reviewing subject content. Choose what to revise based upon your self- assessment at the end of each topic.

Apply what you reviewed to suitable exam questions.

Finally check your answer/s, use the mark scheme to self-assess. Then if it's not perfect re- draft; this can be done immediately or at a later date.

You may choose to complete each stage within a one-hour session.

LINKS



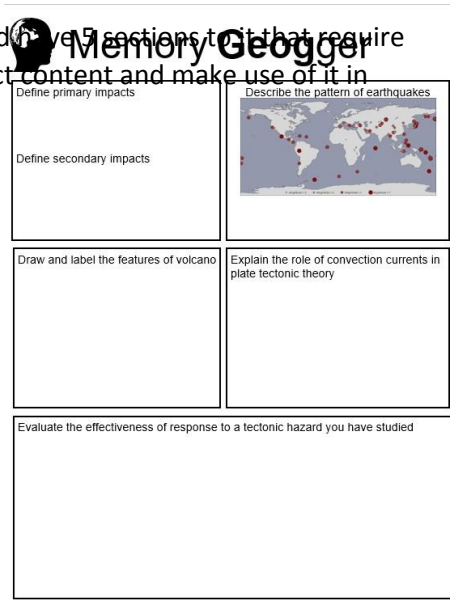
How to use in Geography

1. Use a model answer from the teacher, pull it apart and identify the key parts. Then answer a similar question and try to replicate.
2. Review content then complete practice questions in timed conditions. Afterwards use your notes to correct / improve your answer. A week later, redo a similar question or repeat as necessary.

Geog your Memory

This method involves downloading or making your own sheets that encourage you to recall and retrieve prior knowledge.

Each sheet should have 5 sections to it that require your recall subject content and make use of it in different ways such as draw & label a diagram, define key terms, list something, describe a pattern and explain something.



How to use in Geography

Break the topic up into 5 bitesize chunks.

Complete a sheet in 5-10 minutes max.

The example shown asks you to

1. Define primary impacts and secondary impacts
2. Describe the pattern of earthquakes,
3. Draw and label the features of volcano,
4. Explain the role of convection currents in plate tectonic theory
5. Evaluate the effectiveness of response to a tectonic hazard you have studied

Knowledge Organiser

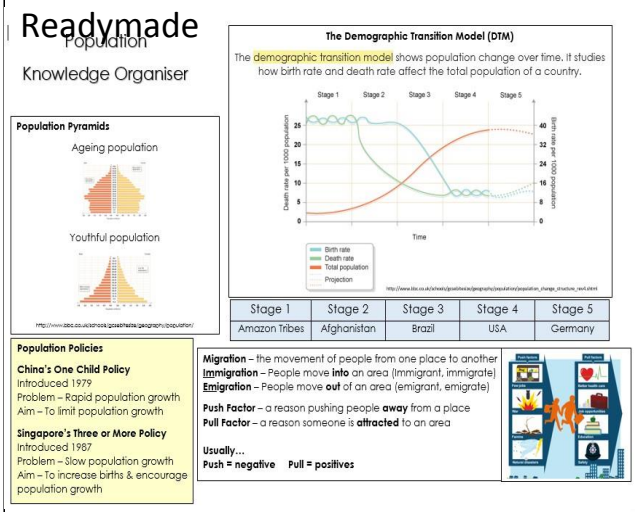
This method involves you creating a summary of the topics into just the 'need to know' information. Forget the fluff. What must you really know?

There are plenty of readymade examples out there which you can make use of to create other revision materials or you can create your own from scratch.

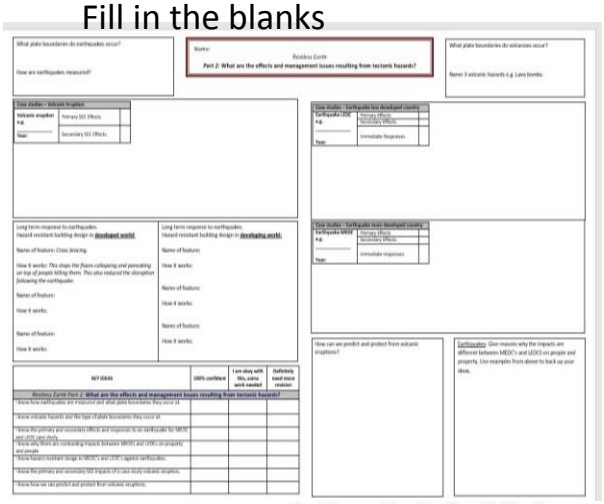
Try duel coding – this means you put your knowledge into words and images. This increases your chances of remembering it.

How to use in Geography

Readymade

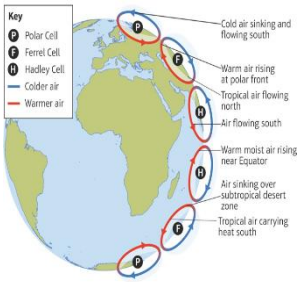


Fill in the blanks



Topic 1A Hazardous Earth: Climate

Key Terms
Coriolis Effect
Polar Cell
Ferrel Cell
Hadley Cell
Weather
Jet Streams
Isobars
Millibars
Intertropical convergence zone
Source areas
Prevailing winds
High Pressure
Low Pressure
Milankovitch cycles
Glacial
Solar variation
Volcanism



The Atmosphere operates as a global system which transfers heat around the Earth.

The earth's atmosphere is constantly moving; the wind movements form a clear global circulation pattern. The movement of air within the atmospheric circulation cells is controlled by heating and cooling. The sun receives all of its heat from solar radiation from the sun. The solar radiation passes through the atmosphere and heats the ground directly. As the ground heats up, it warms the air above it, so warm air rises and transfers heat to the atmosphere. Later this cools, becomes denser and sinks towards Earth.

As the earth is roughly spherical, more solar radiation is received at the Equator, the hottest part of the Earth's surface. This means the poles are the coldest as they receive the least solar radiation as there is a larger distribution area and the radiation has travelled further and lost heat along the way.

Winds are caused when the air moves from a high (air sinks) to low (air rises) pressure. However, because the Earth rotates, the air does not flow in a straight line, so winds flow in a curved path called the CORIOLIS EFFECT. In the Northern Hemisphere winds are deflected to the right and in the Southern Hemisphere to the left.

JET STREAMS can also have an impact on air movement. Jet Streams form mostly at the boundaries of the main circulation cells (e.g. at the boundary of the Polar Cell and the Ferrel Cell) where there is a significant temperature difference. These are high winds that occur. These streams can affect the movement of other weather systems and can therefore change the weather for different areas.

The oceans also redistribute heat effectively around the Earth. The water near the Equator is hotter than near the poles and again water moves from hot to cold areas. This is helped by the movement of the wind across the ocean. The currents in the ocean move as the cold water sinks and warm water rises. This means a locations proximity to water can have a large effect on its climate as water can hold heat for a long time.

Exam questions

1. Explain how the Gulf Stream redistributes heat (2)
2. Explain the difference in solar radiation received at the Equator compared to the poles. (4)
3. Explain how high and low atmospheric pressure systems occur (4).
4. Explain how ocean currents transfer heat energy around the Earth. (4)

Eccentricity - The orbit of the Earth changes approximately every 100,000 years. This means that sometimes the Earth's orbit around the Sun is more circular, making us warmer (Interglacial), and sometimes the orbit becomes more elliptical, making the Earth cooler (Glacial).

Several natural processes can lead to climate change. One of these processes is **Milankovitch Cycles.** These are natural changes to the Earth's orbit and position that affect how much solar radiation we receive from the sun.

Axial Tilt - The Earth is tilted so that the poles are rotated approximately 23^{o} from a vertical position. This is what creates seasons. Over a 40 000 year period the angle of the tilt changes. This means the Earth is tilted further away from the sun making the seasons more pronounced or nearer to the sun making the differences in seasons less obvious.

Precession - As the Earth rotates on its axis, it doesn't rotate perfectly. It tends to 'wobble' as this happens, the direction the axis is facing changes. This affects our seasons and creates a greater or smaller difference between summer and winter. This happens every 24,000 years.

Climate change refers to how the average climatic conditions of the planet vary over time. The Earth has gone through cycles of warm (interglacial) periods and cold (glacial) periods. The planet's climate during the Quaternary period (the last 2.6 million years) has changed many times.

Evidence for natural climate change -

Ice Cores - Ice sheets in Greenland or Antarctica has built up over hundreds of thousands of years (800,000 in Antarctica). In some places the ice is 3000 metres deep. As the snow falls and gets compacted it creates layers of ice. As the ice forms it traps air bubbles, which contains a sample of the atmosphere at the time it was frozen. As well as this water has isotopes depending on temperature which are also frozen in the ice. When scientists analyse the ice they can tell what the temperature was like and what the atmosphere contained. To get the ice cores scientists drill bore holes into the ice.

Tree Rings- As trees grow they produce growth rings that can be seen in a cross section of a trunk. Growth rings are wider in warmer and wetter regions and narrower in cold and dry climates. Analysing the rings can indicate what the climate was like for 100-1000 years.

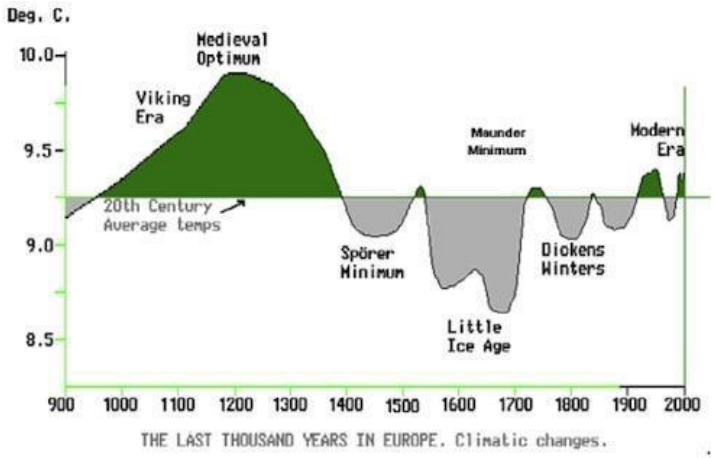
Historical sources - Historical documents such as diaries, paintings and religious records, to examine more recent historical climates. These documents describe the climate of the time e.g. the Anglo-Saxon Chronicles were recorded by English Monks from 890 to the middle 1100s.

Other natural causes of climate change

- Solar variation - The amount of radiation the Sun produces varies over time. Periods of lower solar activity are likely to lead to glacial periods and those with higher activity to lead to interglacial periods.
- Volcanism - Large-scale volcanic eruptions can eject huge volumes of ash and dust into at the atmosphere. Some eruptions produce so much that the volcanic material partially blocks out solar radiation, reducing global temperatures and causing cooler periods.
- Surface impact - Large cosmic material, such as asteroids and comets can impact the Earth's surface. This can eject large volumes of dust into the atmosphere blocking solar radiation, which can lead to glacial periods.

Exam questions

1. Climate change refers to the average climatic conditions of the planet over time. Explain how eccentricity can affect our climate. (4)
2. Explain how tree growth can help us prove past climatic conditions. (4)
3. Assess the following statement. 'The causes of past climate change and current global warming are different.' (8+3)



The global climate is now changing due to human activities and we are uncertain about the future.

The greenhouse effect— A natural process which keeps the Earth warm. Greenhouse gases in the atmosphere act as a blanket and trap solar radiation that is being radiated back out to spade from Earth. Without this the Earth would be much cooler.

The enhanced greenhouse effect—Human activity has increased the amount of greenhouse gases being released into the atmosphere. This means the Earth absorbs more solar radiation and as a result is becoming warmer.

Human activities—

Energy—The demand for energy is increasing as the population increases, standard of living improves, technology improves and people become more affluent.

Industry—As people have more disposable income increases so does the demand for products from consumers leading to industrial growth. This leads to more fossil fuels being used.

Transport—As cars are becoming more affordable more people are buying and using them. As well as this, flights are now cheaper so people fly more. All modes of transport rely on fossil fuels at present.

Farming—As the population has grew the need for more food has increased leading to more intensive agricultural practices that require machinery.

Evidence of human induced climate change

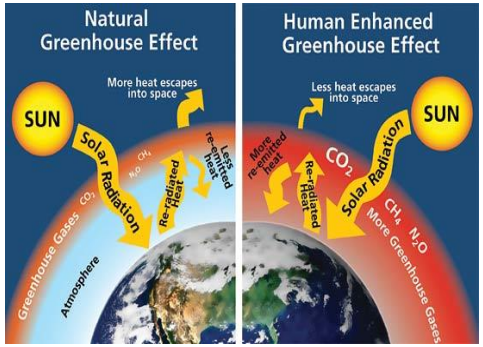
1. Measurements of average global temperatures have risen more rapidly from the 1950s.
2. There is an increase in CO2 in the atmosphere since 400,000 years ago.
3. Measurements of sea levels show that they have risen globally by 20cm since 1900 due to thermal expansion and melting ice sheets.
4. Global sea temperatures have increased on average by 1^{o}C.
5. The extent of sea ice has decreased each year.

Consequences of climate change

1. Biodiversity loss
2. Rising sea levels leading to flooding
3. More intense and frequent tropical cyclones.
4. Pests and diseases more widespread
5. Food supplies affected
6. Water supply issues due to loss of glaciers
7. Longer and more frequent droughts
8. More frequent and intense rainfall

Increased temperatures

Warmer temperatures can impact on food production as some areas will have more drought conditions. Also diseases will spread quicker as warm weather encourages the spread of pests. Water supplies in some places will reduce having consequences on people's health and lifestyle. Habitats will change which will reduce biodiversity as animals and plants struggle to adapt.

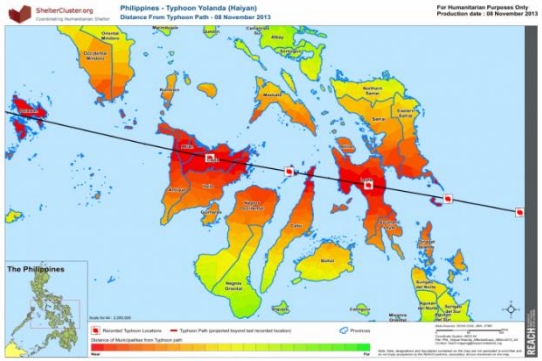


Exam questions

1. Humans can impact climate change by producing excessive amounts of greenhouse gases. Explain one way in which greenhouse gases can be produced by human activity. (2)
2. Climate change can have negative impacts on people and the environment. Suggest one way in which climate change can have negative impacts (2)
3. 'It is not possible to make accurate predictions about the possible consequences of climate change' Assess this statement (8+4 SPAG)

Tropical cyclones present major natural hazards to people and places.

Name of the hazard	Impact on people	Impact on the environment
High Winds	Infrastructure such as power lines damaged Buildings destroyed Loss of life, injury	Trees uprooted
Intense Rainfall	Damage property Injury Potential loss of life	Flooding Pollution of water systems
Storm surges	Coastal defences destroyed Flooded inland areas contaminating farmland Damage to properties	Beaches and coastal habitats destroyed
Coastal Flooding	Peoples lives and properties at risk of destruction Farming, tourism and industry at risk of	Salt water intrusion Habitats destroyed Water contamination
Landslides	Settlements destroyed/damaged Transport routes cut off Loss of life and injury Displacement	River flooding if a channel is blocked Habitats destroyed Debris contaminated water



Exam questions

1. Explain why some areas are more vulnerable to the impacts of tropical cyclones than others. (4)
2. Explain how a storm surge is created (2)
3. What is the most important feature the Saffir-Simpson model measures? (1)
4. Explain the social, economic and environmental impact of the physical hazards created by a tropical cyclone (6)

Saffir-Simpson Hurricane Scale		
Category	Wind Speed (mph)	Type of Damage
1	74-95	Some Damage
2	96-110	Extensive Damage
3	111-129	Devastating Damage
4	130-156	Catastrophic Damage
5	157 and above	Catastrophic Damage

Measuring cyclones

The Saffir-Simpson scale is used to classify tropical cyclones. It is based on the wind speed generated by the cyclone and estimates the damage.

Vulnerability to cyclones

Physical vulnerability

Coastal areas are at a significant risk to the hazards created by tropical cyclones as they form in oceans and seas. This does not mean inland areas don't suffer from the effects. Island nations such as the Maldives and the Philippines are more vulnerable as they are surrounded by warm water and have a low relief. Therefore, they are more likely to suffer from flooding, storm surges and high wind speeds. However, areas of high relief are at risk of heavy rain and landslides.

Social Vulnerability

Social inequality can make some areas more vulnerable. Areas with high poverty are more vulnerable as the houses and infrastructure will not be as stable, therefore it will be easily damaged or destroyed. The after-effects are also felt more in poorer regions as people may not have access to food, water and shelter or medical supplies. Therefore, more people are likely to suffer and die compared to people in more affluent areas who may be more prepared.

Age is another social inequality. Areas with higher or lower average ages are more vulnerable. Older people and younger people are more likely to suffer an injury during disasters and have more difficulty evacuating. The young and old are also more vulnerable to catching illnesses and diseases as their immune systems are not as strong.

Economic Vulnerability

Countries with higher levels of development are likely to have access to accurate weather prediction and monitoring systems so they can predict the tropical cyclones landfall and evacuate people. They may also have coastal defences meaning that storm surges pose less of a hazard. Affluent countries will also have well-stablished evacuation procedures and disaster response teams prepared for any impacts.

Tropical cyclones are caused by particular meteorological conditions

Tropical cyclones - Large scale rotating storms that form over oceans in tropical regions.

Structure:

⇒ Above tropical cyclones they have a dense canopy of cirrus clouds due to uplift of warm, moist air as the cyclone is forming.

⇒ Swirling around the centre of a cyclone are rain bands—these can stretch 1000km from the centre of a cyclone

⇒ At the centre of the tropical cyclone is the eye (calm conditions), and around it is the eye wall (strongest rainfall and winds) which can rise 15km into the atmosphere.

⇒ The eye is an area of high pressure as air falls, the eye wall is an area of intense low pressure.

Formation

- High sea temperatures (above 26.5^{o}C) cause air to rise in a low pressure system. The rising air creates thunderstorms which group together, creating a strong flow of warm, rapidly rising air.

As well as this several other conditions are needed for the low pressure system to become a full tropical cyclone:

- Time of year (season) when ocean temperatures are higher
- Winds converging at the ocean surface causing the air to rise
- Formation away from the Equator so Coriolis can take effect
- As the storm rotates winds accelerate inwards and upwards, making the depression stronger and forming an eye.

Intensity of Tropical Cyclones

Tropical cyclones need warm water to form, they also need the Coriolis effect for them to rotate hence they are not located at the Equator. As well as this they need—

- High humidity– there must be a lot of moisture in the atmosphere.
- Rapid cooling– rising air must condense quickly to form the rainbands
- Low wind shear– if winds are blowing in different directions in the atmosphere a cyclone cannot form.
- Pre-existing low pressure– for the air to rise and generate a storm.

ITCZ influence - All the factors above tend to occur at the ITCZ This is the main source area for tropical storms as the air rises and travels towards the poles in the Hadley cell.

Intensity - Tropical cyclones are powered by heat energy that is released as warm air condenses. The majority of this air is used to force air upwards into the atmosphere. Only a small amount is used to create a cyclone. Therefore, the warmer the water the more intense the storm.

Dissipation – when cyclones lose their energy and decrease in intensity due to:

1. When it reaches land it loses the fuel for energy (warm water)
2. When it moves to an area of cold water (below 26 degrees)
3. When it runs into another weather system where the wind is blowing in an opposite direction.

Why do they spin?

Winds are created due to air moving from an area of high pressure to low pressure. However, this is affected by the Coriolis effect meaning the rushing winds are deflected into a spin as the Earth rotates.

Northern Hemisphere—Counter clockwise

Southern Hemisphere– clockwise

Source areas and Track

The area where a tropical cyclone is formed is called a source area (Areas with the formation conditions).

Tropical cyclones have seasonal distribution e.g. June to November in the Northern Hemisphere and April to November in the Southern Hemisphere.

Cyclones travel in the direction of the prevailing wind and ocean currents this is called its Track.

Exam Questions

1. Suggest two reasons for the distribution of tropical cyclones (4)
2. Describe what would happen if a tropical cyclone moved into colder sea water
3. Explain the conditions needed to form a tropical cyclone (4)

The impacts of tropical cyclones are linked to a country's ability to prepare and respond to them

Preparing depends on accurate forecasting and effective communication to people at risk.
Ways of preparing:

- Atmospheric Pressure—Measuring atmospheric pressure is the most common forecasting method, and the one that gives the earliest information on a potential tropical cyclone hazard. Areas of very low pressure are likely source areas for tropical cyclone formation.
- To get accurate readings of what ocean temperature and atmospheric pressure conditions are like, scientists use buoys which are anchored in the ocean. Ships in the area also measure conditions and send readings to shore. The readings enable forecasts to be made about possible storm surges so people can evacuate and board their houses.
- Satellite tracking and radar– Satellites allow huge areas of ocean to be monitored for the formation of distinctive cloud formations in tropical areas. The progress and track of cyclones if formed are tracked in this way so a prediction about landfall can be made. Once a cyclone has developed an eye it is easy to locate, before this it can be difficult. Radar can also be used this registers the amount of precipitation in an area, so it can provide information about rainfall. However, these are both expensive technologies.
- Modelling—Atmospheric pressure data, sea temperature data and information on wind speeds can be put into sophisticated computer modelling systems that estimate the likely track of cyclones and the predict the amount of devastation it may create. Expensive .
- Communicating information– When a cyclone is forecast to make landfall, the government will activate any defences in the area, order evacuations in areas at risk and prepare are regularly given information and training about being prepared. Information about the cyclone will also be broadcast by the media.

CASE STUDY—Typhoon Haiyan, Philippines (Emerging country), 2013

2/11/2013— Typhoon Haiyan was the strongest tropical cyclones on record which was a category 5 on the Saffir-Simpson Scale

Preparation— The Philippines was assisted with tracking the typhoon by Japan. The Government used the Public Storm Warning Signal (PSWS) to warn people across the country. Originally only a level 1 warning was given. Those that were in areas at risk of flooding or landslides e.g. Samar and Leyte) were evacuated to safer areas. The military were ordered to send planes and helicopters to the region to help with the aid effort. 5m high storm surges.

Response –7 provinces were placed under a 'state of national calamity'. The relief effort was slowed by blocked roads and damage to airports. Some areas were isolated for days. No sources of clean water available due to burst pipes and contamination. People in cities such as Tacloban needed evacuating as there was no electricity, clean water, food or shelter. However this could only happen during daylight hours. More aid went to Tacloban than any other area meaning other areas felt abandoned.

Exam questions

1. 'Effective preparation is the best way to reduce deaths from tropical cyclones' Assess this statement. (8+4SPaG)
2. Explain the difference between preparing and responding to a cyclone (4)
3. Give one example of preparation for a developing country (1)
4. Give an example of preparing for a developed country (1)
5. Explain why developed countries prepare better than developing and emerging countries. (6)

Responding to Tropical Cyclones

Response refers to how people deal with the effects of a cyclone after it has occurred.

- Teams of rescue workers will search for people who are trapped in rubble and collapsed buildings.
- The government and charities will provide food, water, shelter and medical care where needed so that victims are safe.
- Repair and construction will occur in the affected area, power will be restored and roads cleared for transport.

Hurricane Katrina, USA (Developed country), 2005

29/08/2005, Hurricane Katrina a category 3 hurricane, made landfall on the South coast of the USA.

Preparing—Very good forecasting and tracking services monitored Katrina and predicted where it would make landfall. The Mayor of New Orleans ordered an evacuation of the city. Many were unable to leave as they didn't have access to a car. The local football stadium (Superdome) was a designated shelter and could hold 1000s of people. Approximately 80% of the city was evacuated. Levees and barriers were built to prevent flooding, however they were overwhelmed by the storm surge and had not been maintained properly so areas such as the 9th ward were flooded.

Response—the local and national response was criticised for not being fast enough. The people in the Superdome were trapped with limited resources (food, water). FEMA were unprepared for the scale of destruction. There were more people that needed help than they prepared for. The poorer areas were the most affected.

Topic 1B Hazardous Earth: Tectonics

Layers of the Earth

The Crust—The thinnest layer. There are two types - oceanic crust and continental crust. Oceanic crust is relatively thin (5-8km). It is made of basaltic rock, so is slightly denser than continental crust, Continental crust is thick on average (30-40km), but its thickness varies and can reach 70km under some mountain ranges such as the Himalayas. It is lighter as it is granitic with is less dense.

The Mantle—This is the thickest layer - nearly 2900km. Its temperature ranges from 1000°C near the crust to 3700°C near the core. It is divided into two layers. The upper mantle is mostly solid, but some melting occurs at hotspots and plate boundaries. As these locations the mantle moves slowly. The mantle becomes hotter and denser with depth. As the pressure is increased the lower mantle is solid despite the high temperatures.

The upper mantle is further divided into the lithosphere and asthenosphere.

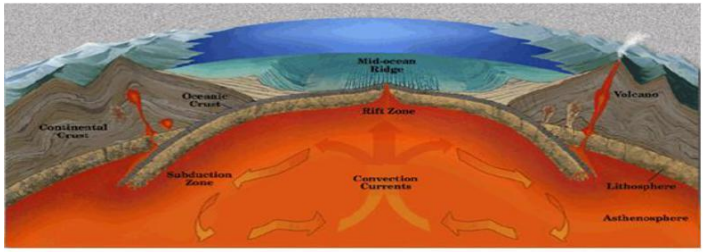
1. The lithosphere—includes the crust and the top layer of the upper mantle which is made of peridotite. The lithosphere is 80-100km thick, although it is thinner under the oceans and in volcanically active continental areas. It is broken up into tectonic plates (lithospheric plates) of varying size which move on the asthenosphere.
2. The Asthenosphere—this is a denser, mobile layer in the upper part of the mantle, about 100-300km deep. The temperatures in the asthenosphere is high (above 1300°C) and the pressure, while still high is low enough that rocks can still move.

The Core—This is the centre of the Earth. It is very hot and dense. It has two layers. The outer core is made of liquid iron and nickel the temperature is between 4500-5500°C The inner core is up to 6000°C. It is a dense solid ball of iron and nickel. It cannot melt due to the pressure.

Convection currents

The plates are continually moving on the asthenosphere due to rising hot currents called convection currents in the mantle. Rock heated in the lower mantle by the core, rises slowly towards the crust. As it rises, it cools. When it reaches the asthenosphere it is forced sideways as it is blocked by the lithosphere above. It then sinks slowly towards the core and is forced sideways due to the dense iron and nickel.

The heat generated to create convection currents comes from radioactive decay (such as uranium) and residual heat (heat left from the earths formation 4.6billion years ago). Convection currents exert a weak 'pull' on the plate above. This causes the plates to move apart or slide past each other. The movement impacts on plate boundaries leading to earthquakes and volcanoes.

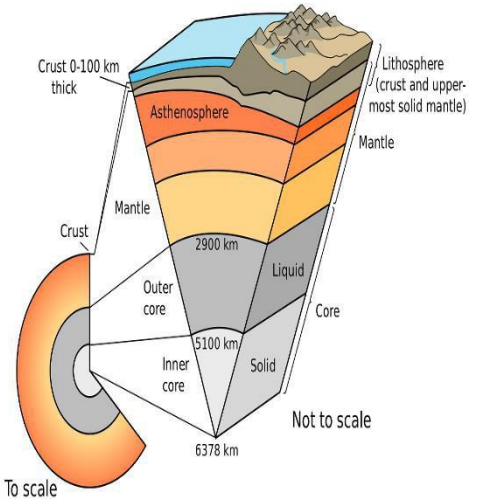


Exam questions

1. State 2 differences between oceanic and continental crust (2)
2. Explain how convection currents cause tectonic plates to move (4)
3. Identify and describe the layers of the earth (4)

Key Terms

Convergent
Subduction zone
Trench
Magma
Composite volcano
Fold mountains
Ocean trenches
Faults
Rift Valley
Shield volcano
Mid-ocean ridge
Transform plate boundary
Divergent plate boundary



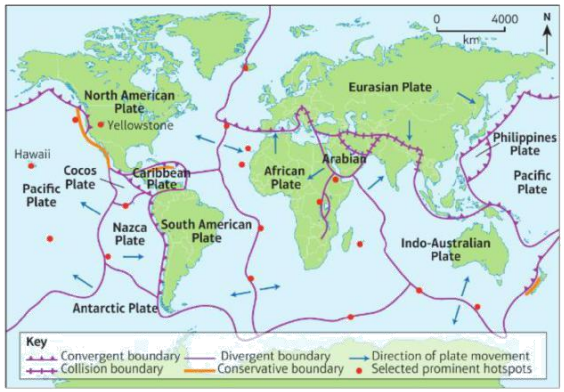
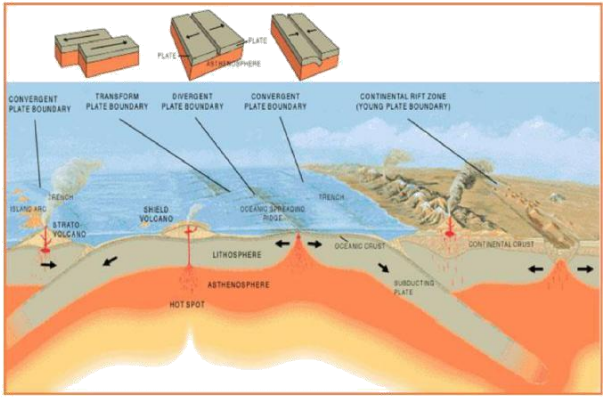


Figure 2 Global distribution of tectonic plates, boundaries and hotspots



Exam questions

Explain the differences between convergent and a conservative plate boundary (4)

Describe the distribution of earthquakes and volcanoes (5)

Describe and explain the characteristics of a convergent plate boundary (5)

Type of plate boundary	Description	Features produced	Example plates and countries.
Convergent (Oceanic and Continental crust)	Convection currents in the mantle cause the plates to move towards each other. The oceanic plate subducts beneath the continental plate as it is denser into the asthenosphere. As it subducts the increase in temperature due to friction and pressure force the crust to lose impurities into the asthenosphere which begins to melt. This creates magma, which can lead to volcano.	Trench Composite volcano Oceanic trench	Peru-Chile Trench, Andes Mountains. Involving the Nazca Plate and South American Plate
Convergent (Continental vs Continental)	Convection currents in the mantle move the plates towards each other. As the plates are the same there is no subduction, the collision causes the boundaries to crumble forming fold mountains. As there is no subduction there is not volcanic activity here. However major earthquakes do occur due to the pressure of the colliding plates which causes rocks to fault.	Fold mountains	Himalayas, Tibetan Plateau
Divergent plate boundaries	Convection currents cause the plates to move away from each other. This mainly occurs under the oceans. As the plates break apart, rising heat and a reduction in pressure causes the asthenosphere to melt, forming magma. The magma rises to fill the rift valley between the two plates creating oceanic lithosphere. Where the magma breaks through to the earth's surface a shield volcano is created. A mid-ocean ridge can then be formed if the process continues. Earthquakes also occur here.	Shield volcano Rift Valley	Iceland—Eurasian plate and North American plate
Transform plate boundary	Convection currents cause the plates to slide past each other. The plates can move in opposite directions or in the same direction but at different speeds. In both examples, the plates tend to get stuck, increasing tension and pressure. The pressure builds until one plate jerks and causes an earthquake.	Fault lines	San-Andreas fault, California, USA—North American plate and the Pacific Plate

Over 90% earthquakes occur along convergent plate boundaries.

Exam questions

1. Define Magnitude (1)
2. Explain how hotspot volcanoes are formed (4)
3. Explain how a composite volcano is formed (4)
4. What measures earthquakes (1)
5. Explain what causes an earthquake (4)

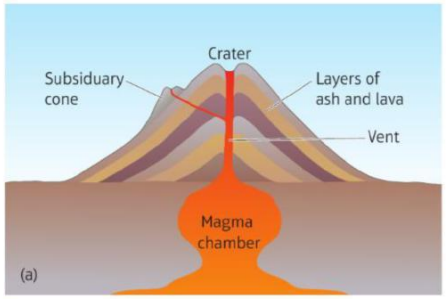
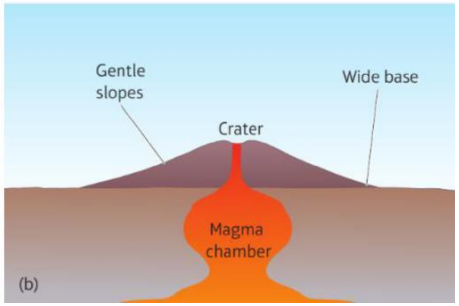


Figure 7 (a) Composite volcano and (b) Shield volcano



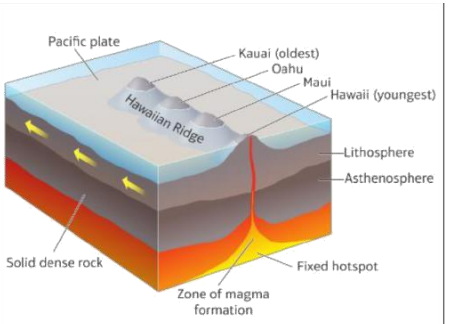


Figure 8 Hawaiian hotspot volcanoes

Types of volcanoes

Volcanoes are formed when molten rock from a magma chamber inside the Earth erupts through a vent in the lithosphere. Molten rock is called magma below the surface and lava when it erupts. As well as lava, volcanoes erupt steam, gas and ash from the crater. There are two main types of volcanoes:

Composite volcanoes—These are formed along convergent plate boundaries. They are steep sided, tall and conical shaped with a narrow base. They are made of alternate layers of ash and lava. Andesitic lava is erupted from these volcanoes. It has a high silica content making it more viscous so it flows slowly and travels short distances before cooling. Eruptions tend to be infrequent but violent, as the vent becomes blocked with lava so pressure builds up. During explosive eruptions the lava shatters into pieces producing, lava bombs and very hot flows of gas (pyroclastic flows). These are a primary hazard. A secondary hazard from these volcanoes is a lahar (hot mudflow).

Shield volcanoes—These are formed along divergent plate boundaries and over hotspots. They are gently sloping domes with a wide base. They are made of lava only, which in many shield volcanoes, erupts from fissures as well as the crater. Basaltic lava is erupted from shield volcanoes. It has a low silica content so it is less viscous meaning it is runny and flows long distances before cooling. Eruptions tend to be frequent but gentle. Whilst lava flows destroy property and crops they rarely kill people.

Hotspots— These are volcanoes that are formed away from plate boundaries. They are formed by a 'plume' of superheated rock (not magma) rising slowly through the mantle. Once it reaches the upper mantle, it causes the asthenosphere and base of the lithosphere to melt. The magma produced then rises through weaknesses in the crust and erupt at the surface. Oceanic hotspots erupt basaltic lava, creating shield volcanoes such as Mauna Loa in Hawaii. Continental hotspots erupt viscous granitic lava. These can erupt explosively e.g. Yellowstone Supervolcano in the North American plate.

Earthquakes

Earthquakes are intense vibrations within the Earth's crust that make the ground shake. They are sudden events.

At a convergent plate boundary great stresses build up in the subduction zone as the edge of one plate sinks below the other. Energy builds up until the rock fractures along a fault and the energy is released. The point of rupture is called the focus. Shockwaves or seismic waves radiate out from this point. These make the earth shake. The epicentre is the point on the ground surface directly above the focus. Earthquakes also occur along conservative and divergent plate boundaries. They are caused as the plate moves and get stuck.

Measuring Earthquakes

The size of an earthquake is recorded using a seismometer. The magnitude (size) is then given according to the Richter scale which gives a value between 1 and 10. The scale is logarithmic, Another scale is the moment magnitude scale (Mw) is frequently used. It is similar to the Richter scale but it works over a wider range of earthquake sizes and is more accurate.

The amount of damage an earthquake creates depends on several factors:

1. The scale of the event in terms of energy, area & duration
2. The depth of the focus
3. The density of human settlements in the area
4. The time of day/week
5. The degree to which the country and people are prepared
6. The level of development

Tsunamis

These are usually triggered by earthquakes and are a secondary hazard. A tsunami is a series of giant ocean waves that send surges of water onto land. When a powerful earthquake occurs under the sea, the seafloor at the boundary either rises or falls suddenly displacing the water above it and setting off rolling waves that build to tsunamis. They can reach speeds of 800kmh. As they approach land, they slow down, grow in height and gain energy. When they crash onto the shore they cause widespread destruction.

Tectonic hazards affect people and are managed differently at contrasting locations

Impacts -Primary impacts are the immediate damage caused by the volcano or earthquake such as injury or loss of life. Secondary impacts are the 'knock on' effects from primary impacts such as shortage of clean water, diseases spreading.

Response— Emergency responses take place immediately after the event such as rescue teams. Long term responses include restoring the area back to normal and managing the area by predicting, protecting and preparing for future hazards. The ability to respond depends on the country's economic wealth.

Predicting volcanoes and earthquakes

Sensitive instruments can measure earths movements such as a seismometer as usually foreshocks occur before a major earthquake and earthquakes occur before volcanic eruptions so scientists and volcanologists can monitor this. A hazard map can be made to show local people areas that would be the most vulnerable. Despite this, earthquakes are extremely difficult to predict compared to volcanic eruptions as they are so sudden. Volcanoes have other features that can be a sign of an eruption such as gas emissions, warnings can be given if air pollution levels increase, snow melt and bulging can be monitored via satellites that can indicate a change in a volcanoes behaviour. Tiltmeters can be installed to measure ground/rock deformation.

Preparing for volcanoes and earthquakes

Earthquake proof buildings can be built as most deaths are caused by falling buildings. These buildings have features such as cross-bracing, shock absorbers and reinforced concrete to reduce the motion of earthquakes.

Education—government agencies, schools and councils can educate locals about the hazards so that they can be prepared for the hazard and its effects such as earthquake drills, evacuation drills. Leaflets can be distributed.

Emergency services—can prepare to respond to a hazard with food, water, shelter and medical aid. Send search and rescue teams and communicate so that the areas that need the most help get it.

Protection — volcanoes and earthquakes

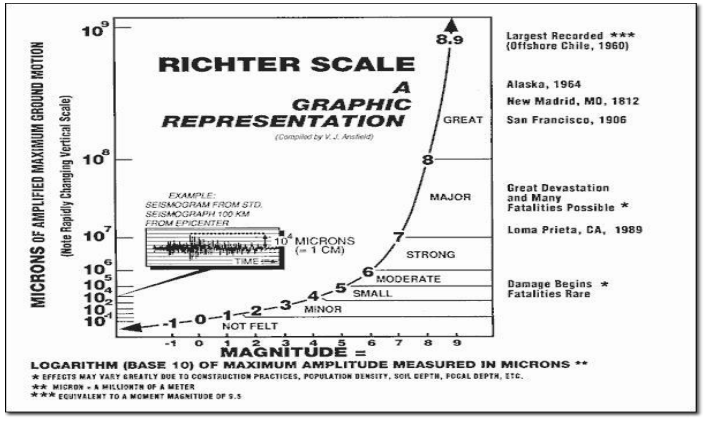
Infrastructure can be built to protect people from buildings collapsing through design.

Earthquake proof buildings have features such as:

- Shear wall—Reinforced concrete walls provide strength and resist earthquakes
- Shear core—Reinforced concrete with steel rods to strength the centre of a building.
- Moat—A gap between the ground and foundations so that the shock waves can move through the base isolators
- Cross bracing—Diagonal steel bars to reinforce the walls
- Base Isolators—Like shock absorbers they dampen the impact of movement. Hazard proofing homes:
- Remove heavy items from the walls
- Secure chimneys with metal brackets
- Fasten bookshelves and cabinets with L-shaped brackets
- Bolt the house to its concrete foundation to prevent it from slipping off.
- Strap heaters and boilers to the walls to prevent them falling
- Learn how to turn the gas, water and electrics off
- Use metal connectors to strengthen joints in the house
- Use plywood to strengthen walls and ceilings.

Exam questions

1. Explain how earthquakes can impact people and the environment (4)
2. Describe one way in which people can predict volcanic eruptions (2)
3. Assess the effectiveness of the management of one tectonic hazard event (8+4)
4. Explain one short term and one long term impact of an earthquake event (4)
5. Explain how the responses to a volcanic hazard can vary between countries at different levels of development (4)



Key Terms

Primary impacts
Secondary impacts
Emergency response
Long term response
Retrofitted
Volcanologists
Tiltmeters
Liquefaction

CASE STUDY—Kilauea, Hawaii, USA—Developed country

It is one of 5 shield volcanoes in Hawaii. It is extremely active, and has been erupting continuously since 1983. It was created due to being on top of a hotspot and its eruptions are effusive basaltic lava flows.

Primary impacts: Since 1983, lava from Kilauea has covered 100km² of land and destroyed 200 homes and community buildings, damaged utilities and blocked roads. In 1990, Kalapana village was buried beneath 15-24m of lava. In 2014, Villagers from Pahoa were evacuated when lava fountains erupted near to the village. The lava reached the sea which causes it to explode which endangers people's lives.

Secondary impacts—In 1986, Kilauea began releasing up to 2000 tonnes of sulphur dioxide a day. This is potentially lethal within a 1km radius of the volcano. This has led to persistent air pollution known as volcanic fog (Vog) and acid rain. This damages crops, vehicles, buildings and contaminates water supplies. However, a positive impact is that over 2.6 million tourists visit Hawaii Volcanoes National Park each year, which generates income for local business. The lava also makes the soils very fertile to grow commercial food crops like sugarcane and pineapples worth US$30million per year to the local economy.

Response—Although it is not generally a threat to human life, the dangers still need to be managed. The Hawaiian Volcano Observatory is located close to the crater and volcanologists monitor the volcanoes and issue warnings about possible eruptions and evacuations. They have 17 webcams and satellite data to monitor activity, gas emissions are monitored and warnings are issued about air pollution levels and seismometers measure any tectonic activity caused by moving magma. However weak planning laws and a growing population have resulted in building in areas at risk from the volcano. There is evidence that historically Kilueau has had explosive eruptions which have not been prepared for.

CASE STUDY—Mount Pinatubo, Philippines 1991— Emerging country

It is one of many composite volcanoes on the island of Luzon. Here the Eurasian plate is subducting beneath the Philippine plate. After more than 600 years of inactivity Pinatubo erupted on the 12th June 1991. Its andesitic lava is thick and full of gas causing explosive eruptions. A cloud of steam and ash was sent 30km up into the atmosphere, and pyroclastic flows descended from the crater at speeds of more than 200km per hour.

Primary impacts—Volcanologists predicted the eruption and advanced warnings allowed thousands of people to evacuate. However, 847 people were killed mainly from pyroclastic flows, the ash cloud made the region cold and dark which stopped rescue teams, 5000 homes were destroyed and a further 70,000 damaged. Many buildings collapsed and many people were displaced to shanty towns in the capital Manila. Power supplies were cut and roads and bridges were unusable. Local water supplies were contaminated.

Secondary impacts—As winds dispersed the ash cloud (10 million tonnes of sulphur dioxide), global temperatures dropped by 0.5°C temporarily. Hundreds of people died from disease mainly measles, pneumonia and diarrhoea in evacuation camps. Crops were destroyed as ash covered 800km² of rice fields and around 800,000 farm animals were killed, with the cost to farmers estimated at 1.5 billion pesos (£20 million). Lahars were created up to 3m high. After wet ash destroyed many buildings, US air forces base at Pinatubo closed and relocated to Singapore. Many Filipinos lost their jobs and local trade suffered.

Response—Several techniques were used to predict the eruption. The Philippine Institute of Volcanology and Seismology (PHIVOLCS) detected swarms of earthquakes beneath the volcano in March 1991, indicating magma movement. Tiltmeters detected rock deformation. Helicopters with gas measuring technology flew over Pinatubo daily. Geologists mapped previous lava flows and lahars to estimate areas at most risk. Warnings were issued and locals were evacuated in advance. Vaccinations were given against measles to prevent outbreaks. International emergency aid was provided after the eruption and lahars.

With the help of international development agencies the Luzon authorities have established long term initiatives to better protect people and their properties including: building dykes and dams to protect against lahars and flash floods, establishing new farms and employment away from the danger area, redeveloping the old US air base into Clark International Airport, where tax free trading attracts businesses employing 47,000 people and New towns and villages have been built outside the danger area.

CASE STUDY—Tohoku earthquake, Japan 2011—Developed country

At 2.47pm on 11 March 2011, an earthquake with a magnitude 9.0Mw shook North-east Japan and triggered a tsunami. The Pacific plate thrust under the Eurasian plate at the Japan Trench. The focus was relatively shallow (30km) and the epicentre was 130km east of Sendai.

Hundreds of aftershocks occurred measuring between 6.0 and 7.0Mw. The earthquake triggered a tsunami that raced outwards from the epicentre at speeds of 800km per hour. Waves were up to 10m high hit the east coast and travelled as far as 10km inland. Primary impacts—Between 667—1479 deaths occurred as a direct result of the earthquake caused by buildings collapsing. Many buildings and railways were damaged. Electric power and sewer systems were disrupted. Reclaimed land in Tokyo suffered liquefaction and more than 1000 buildings were damaged.

Secondary impacts—The vast majority of deaths (over 17,000) were due to drowning. More than half the victims were aged 65 and older. A further 5000 were injured or reported missing. Over 127,000 buildings collapsed and 1.2 million were severely damaged. More than 2000 roads, 56 bridges and 26 railway lines along the entire east coast of Honshu Island were destroyed. The Fukushima nuclear power plant dam burst and the power supply to the station was cut. The waves also hit the back-up generator, causing a nuclear meltdown as the cooling systems failed. The World Bank estimated the damage would cost in excess of US$300 billion in Japan alone.

Immediate and long-term response— Advanced warnings of the earthquake and tsunami gave people time to get outside and reach higher ground. The Pacific Tsunami Warning Centre warned the coastal communities in Japan and around the world of the tsunami. Rescue workers and Japanese soldiers were mobilised to deal with the crisis. The government requested international aid and Australia, China, India South Korea and the USA sent search and rescue teams. The Red Cross and Red Crescent provided support as did private companies and NGOs. Rescue efforts were hampered due to blocked roads and lack of communication, as well as bad weather. More than 130,000 were displaced with many in shelters with limited supplies of food, water and aid. A further 140,000 were evacuated from a 20km radius around the Fukushima plant. The following weeks over 10,000 prefabricated temporary houses were set up in Sendai. Honshu's communications and transportation systems were partially restored. The power supply took longer to come back online reducing the regions manufacturing and business output even further. By late summer the economy was growing again. In February 2012, the government sent up an agency to rebuild in the Tohoku region, which is expected to take 10 years. By early 2015, it was reported nearly all the debris from the disaster had been removed and work had started on a new sea wall.

Reducing the impact—Earthquakes cannot be predicted. Therefore, emergency services are being trained to be more effective, schools, business and organisations practice drills. 1st September each year us a National Disaster Prevention day. New buildings are built according to strict building codes to ensure they are able to stay up during an earthquake and older buildings are being retrofitted to be stronger.

CASE STUDY—Haiti earthquake 2010—Developing country

At 4.53pm, on 12th January 2010 an earthquake with a magnitude 7.0 struck Haiti. It was caused by the conservative plate boundary between the North American Plate and the Caribbean plate. The Epicentre was 25Km South-west of the capital Port-au-Prince. The focus was very shallow (3km). Aftershocks ranged between 5.5 and 6.0.

Primary impacts — 316,000 died, 300,000 injured estimated by the Haitian government, 3 million were affected by the earthquake. 1.5 million, were made homeless and more than 180,000 homes were destroyed. These people were forced into squalid camps with limited supplies. All 8 hospitals were destroyed, around 5000 schools were damaged or destroyed and all 3 universities collapsed. One prison collapsed and 4000 inmates escaped. The port at Port-au-Prince was severely damaged and the airport control tower collapsed hindering the response and aid. Electricity, water, sanitation and communications were badly disrupted.

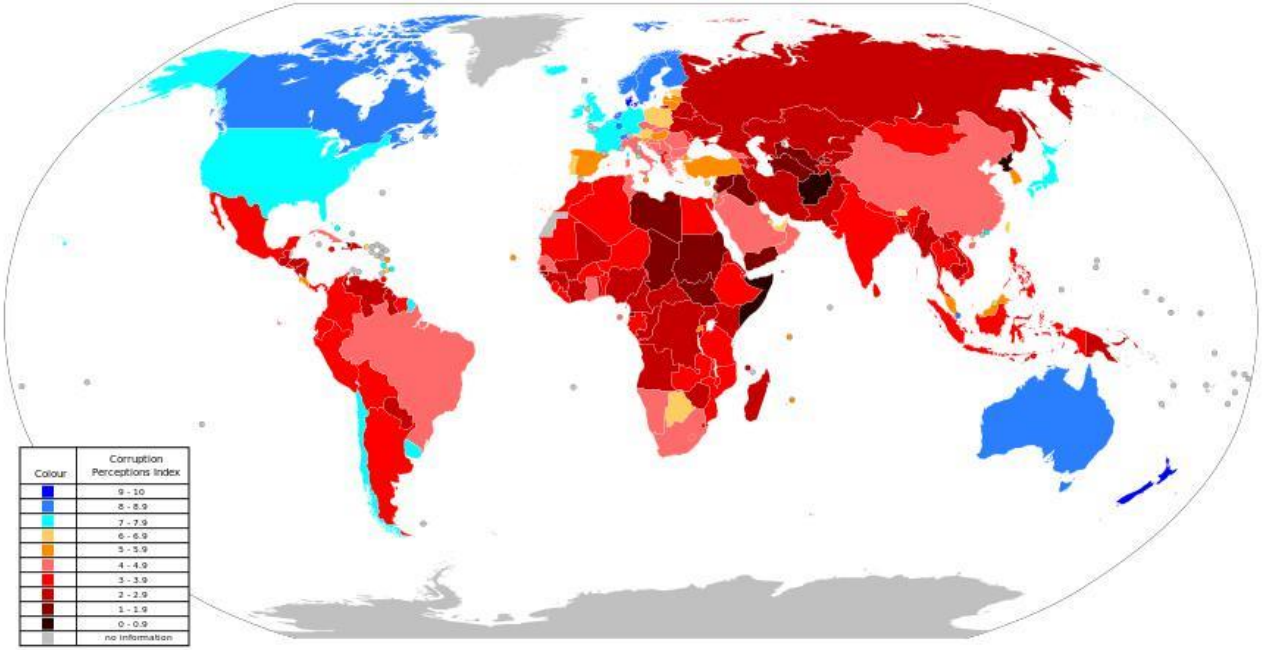
Secondary impacts—Cholera spread throughout the aid camps. The camps provided little protection during the hurricane season. Factories closed and tourism stopped decreasing the economy. Looting and crime increased as the government and police force collapsed.

Response—Haiti is one of the poorest countries in the Caribbean. It was unprepared for the event and could not respond adequately. In the first few days after the event, aid workers reported no one seemed to be in charge. International aid in terms of search and rescue teams were flown in. Food, water, shelter and medical supplies were brought in by the USA and Dominican Republic. American engineers and divers cleared the port so the waiting ships could unload the aid. The UN and US troops provided security to maintain law and order and distribute aid. The UK's Disasters Emergency Committee (DEC) raised £100 million, which was used to provide emergency shelters, medication, bottled water, purification tablets and sanitation. In the weeks and months to come (long-term responses) the government moved 235,000 people from Port-au-Prince to less damaged cities. Many wanted to leave. 3/4 of the damaged buildings were inspected and repaired. Earthquake resistant techniques were used in some cases such as using old tyres, bamboo and straw bales which help take the impact of seismic waves. 200,000 people were paid or received food for public work, such as clearing debris. The World Bank cancelled Haiti's debt repayments for 5 years. However, by 2013, less than half the US$4.5 billion pledged had reached Haiti. Oxfam estimated that by 2015 there was still 500,000 homeless people without water, sewage systems or electricity. A cholera epidemic began 10 months after the earthquake killing over 8000 people and infecting 6% of all Haitians.

Topic 2: Development Dilemmas

Development is a term that measures how advanced a country is compared to others. It relates to standard of living, quality of life and wealth.

- GDP (Gross Domestic Product): The total value of goods and services produced by a country in a year
- Life expectancy - the average age to which a person lives
- Infant mortality rate - counts the number of babies, per 1000 live births, who die under the age of one.
- Poverty Line – the minimum level of income to meet a person's basic needs. The World Bank considers this to be $1.25 per day.
- Dependency ratio: the proportion of people who are too young (0-14) or too old (over 65) to work. It is calculated by adding both groups together and dividing that by the number aged 15-64 (the working population) and multiplied by 100. The lower the number, the greater the number of people able to work.
- Literacy rate - is the percentage of adults who can read and write.
- Maternal mortality: The number of mothers per 100000 who die in childbirth.
- Access to safe drinking water: the percentage of the population with access to an improved water supply.



Corruption Perceptions Index: devised to help investors work out where their money would be safest. The index uses a scale from 10 (honest) to 0 (very corrupt). In corrupt countries, money is used to bribe officials.

The Human Development Index (HDI)

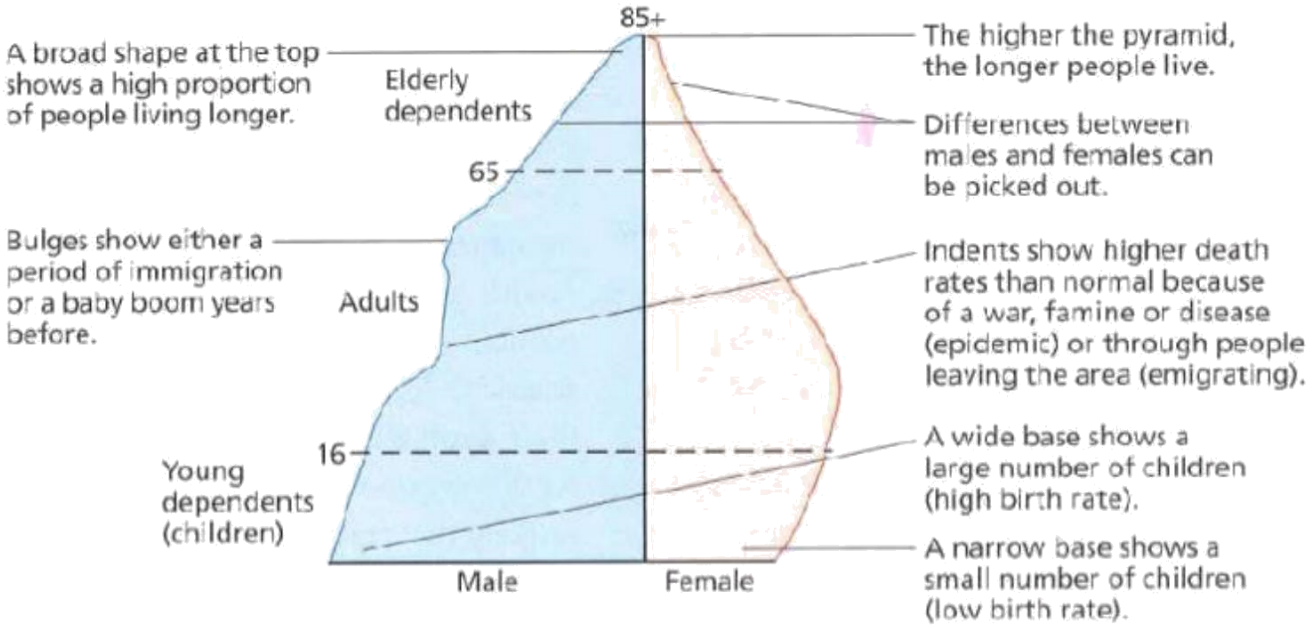
Some countries with a high GDP have a very unequal distribution of wealth e.g. Qatar and the United Arab Emirates The UN created the HDI to measure development. It consists of a single figure between 0 and 1 (the higher the number, the better). HDI is calculated using 3 indicators.

- Life expectancy
- Literacy rate
- GDP per capita (using PPP$)

GDP and HDI are closely linked - poorest countries in the world for GDP have the lowest HDI.

Example Exam questions

1. Describe one example of an economic measure of development (2 marks)
2. Explain some of the problems of only using economic measures of development (4 marks)



Causes of global inequalities

- Physical environment
- History – colonialism
- Political and economic policies

The physical environment – access to the sea is an important influence. For example, many landlocked and mountainous countries have developed more slowly than coastal nations because trade is more difficult for them. Climate is also influential. Tropical countries have grown more slowly than those in temperate latitudes because they experience a higher incidence of climate-related diseases, which are often carried in the water. Natural hazards, such as earthquakes, hurricanes, floods and drought, can also slow or reverse development in some countries.

History – **colonialism** occurred mainly in the 18th and 19th centuries as European powers, such as the UK, France and Spain, expanded their territories around the world. They exploited their colonies for economic gain, and unequal trading relationships distorted local economies, which meant that many colonies received little benefit. In the modern world, the term '**neo-colonialism**' is used to describe how rich countries can still dominate poorer countries. This now happens in an economic and political sense.

Political and economic policies – **open economies**, such as the UK, encourage foreign investment and have developed faster than **closed economies**, such as North Korea, where imports and exports are not allowed. Investment creates jobs and helps to fund infrastructure. Political mismanagement and corruption can slow or reverse development. Zimbabwe, once one of the most developed African countries, has suffered severe setbacks in welfare and human rights because of poor government and the impact of HIV/Aids.

Example Exam questions

1. Explain why infant mortality rates vary between countries (4)
2. Explain two ways in which population structure can influence social issues (4)

Population pyramids:

They show the structure of a country's population in terms of gender and age.

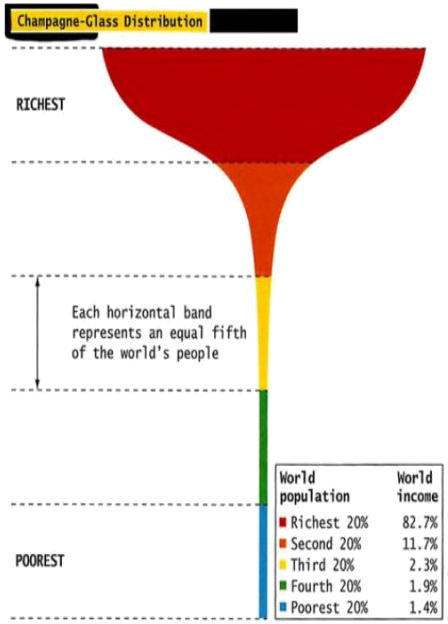
Wide bases – high fertility. Decrease as you go up the pyramid shows high infant and child mortality rates. Life expectancy is low due to high death rate in all ages.

Straight-sided base – decline in fertility rate but still lots of young adults in child bearing years Narrow base – low fertility rate

Triangle shape – high infant mortality rates. Death rate is high in all age groups so life expectancy is low

Square shape – working age population with a long life expectancy

Upside down triangle – population is highest for older people. Death rate is higher than birth rate so country experiences natural population increase

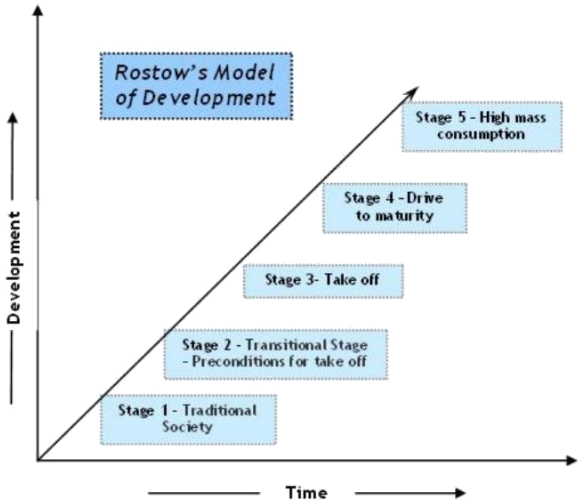


Rowstow's theory

Rowstow was an American economist who published his theory in 1960 based on the experiences of North America, Europe and Australasia. He believed that all countries pass through five stages of development and it is a path that countries like Malawi have to follow.

1. **Traditional society:** most people work in agriculture, but produce little surplus (extra food which they could sell). This is a 'subsistence economy'.
2. **Pre-conditions for take-off:** there's a shift from farming to manufacturing. Trade increases profits, which are invested into new Economic industries and infrastructure. Agriculture produces cash crops for sale.
3. **Take off Stage. This is the fastest growth stage of the model. The majority of people work in manufacturing based industries and the** Tertiary sector is growing. The wealth gap grows but the country experiences its fastest rate of development.
4. **Drive to** Social **maturity:** a period of growth. Technology is used throughout the economy. Industries produce consumer goods.
5. **Age of high mass consumption:** a period of comfort. Consumers enjoy a wide range of goods. Societies choose how they spend wealth, either on military strength, on education and welfare, or on luxuries for the wealthy.

The Rostow model has been criticised for being based on European countries and overlooking other ways in which countries can develop. It also assumes that all countries start with the same resources and geographical factors e.g. population and climate



Frank's dependency theory

Frank's dependency theory believed that development was about two types of region – core and periphery.

The core represented the developed countries (North America, Europe and Australasia) and the periphery consists of other areas which produce raw materials to sell to the core.

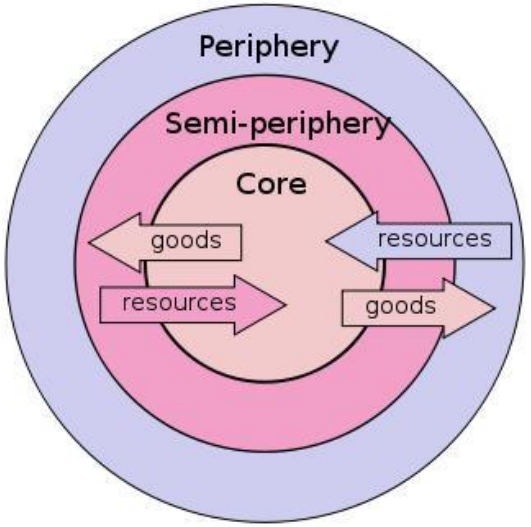
Low value raw materials are traded between the periphery and the core. The core processes these into higher value products and become wealthy. Frank believed that historical trade had made these countries poor in the first place and are weaker members of the global society.

Support for the dependency theory:

- Rich countries interfering with the internal politics of developing countries
- Unbalanced trade – developing countries sell materials cheaply but buy expensive goods
- Selling of non-essential products to developing countries e.g. Coca Cola
- Aid being tied to wider agreements so developed countries get something in return
- Developing countries getting into debt after borrowing too much from the developed world

Criticism for the dependency theory:

- Some countries that were never colonised (e.g. Ethiopia) are still poor
- Socialist systems do not help them to develop (e.g. Tanzania)
- Very poor countries (e.g. South Korea) have managed to develop
- Develop country influences e.g. (neo-colonial) may be positive
- Campaigns e.g. 'Make Poverty History' and 'Free Trade' are positive links between core and periphery

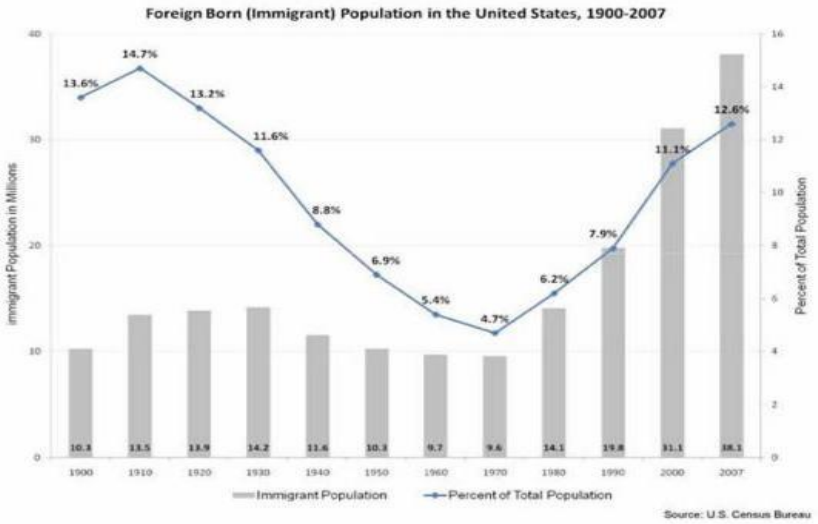


Consequences of global inequality

- Economic - About 1 in 5 of the world's population live on less than $1 a day, almost half on less than $2 a day. Developing countries frequently lack the ability to pay for food, agricultural innovation and investment in rural development.
- Social - More than 775 million people in developing countries cannot read or write. Nearly 1 billion people do not have access to clean water or sanitation. Many developing countries do not have the ability to combat the effect of HIV / AIDs.
- Environmental - Developing countries have increased vulnerability to natural disasters. They lack the capacity to adapt to climate-change-induced droughts. Poor farming practices lead to environmental degradation. Raw materials are exploited with limited economic benefit to developing countries and little concern for the environment.
- Political - Some developing countries have non-democratic governments or they are democracies that function poorly.

Migration

International migration can be a major consequence of inequality between countries. Globalisation has led to increased awareness of opportunities in developed countries. With advances in transportation and a reduction in the relative cost, the potential mobility of the world's population has never been higher.



Factors contributing to development

Trade: Trade and investment play a key role in economic development. Investment is important in increasing its trade. However, 2 billion people live in countries where trade has fallen in relation to national income. This results in less links to global systems and therefore means less FDI for the country.

Fair Trade: Poor countries argue that world trade is unfair. Under fair trade small-scale producers group together to form a cooperative. The cooperatives cut out the 'middlemen' and deal directly with companies in developed countries. This gives farmers more money and therefore a better standard of living. They also then have additional money to reinvest into their farms.

Aid – assistance I the form of grants or loans at below market rates. Aid forms a vital part of the income for many poor countries. Most developing countries have been keen to accept foreign aid for several reasons:

Foreign exchange gap – countries do not have enough money to pay for imports e.g. machinery that is needed for development

Savings gap: population pressures mean there is not enough finance to invest in industry and infrastructure

Technical gap – caused by a shortage of skills needed for development

Two types of international aid – official government aid ad voluntary aid. What is important is how the aid is spent, not necessarily the amount. Critics of foreign aid say it can be wasteful and create a culture of dependency

Importance of remittances: International migrants send money back to their families in the country of origin. These remittances can be very important I fighting poverty and helping economic development.

Debt relief - Western governments (USA) encourage conservation by agreeing to cancel some of the debt they are owed if the other country (Costa Rica) spends that money protecting their environment. Heavily Indebted Poor Countries (HIPC) Initiative established by the IMF and World Bank approves debt reduction in developing countries. 36 countries, with debts of US$7 billion have had debt-service relief since 199.

Location of India

India is located in Asia. Its neighbours are China, Nepal, Pakistan.

It has a border with the Indian Ocean and the Arabian Sea. India is large! With 3.3 million sq km, it is 13 times larger than the UK, though it's only a third the size of the USA. But as a country, it's much more significant than size alone!

Environment of India:

- Rich biodiversity. While elephants and tigers are well known, its diversity includes 6% of the world's bird and plant species. However, population and economic growth threaten them.
- Worst environmental problems, with land, air and water pollution. India is the world's third greatest emitter of greenhouse gases.
- India has a range of landscapes and climates with a powerful monsoon.

Culture in India:

- Is the birthplace of four of the world's religions, Hinduism, Buddhism, Jainism and Sikhism.
- Is diverse. In 2011, 78% of the population practiced Hinduism, 15% Islam, 2.5% Christianity, and 2% Sikhism.
- Has amongst the world's most ancient cultures, with Hindu civilisations traced back over 5000 years.
- Now has the world's largest film industry, Bollywood, producing over 1200 films each year!

Politics in India

- **The world's largest democracy - in 2015, 672 million people were registered to vote.**
- **A growing global influence. It was one of the founding members of United Nations and of the G20 industrial nations. It takes part in UN peacekeeping missions and contributes the second-largest number of troops to the UN.**

Society in India

- **The world's second largest population, 1.25 billion in 2015! By 2022, that will probably overtake China to become the world's largest.**
- The **world's 4th and 5th largest cities - Mumbai (population 16 million) and Kolkata (15 million).**
- **Some of the world's worst urban slums, housing 40 million people, a quarter of its urban population.**
- **Indian society is divided into social ranks known as 'castes' – a person's caste is determined at birth by their parents' status. The bottom of the groupings are known as 'untouchables'. They have no caste and do the most menial of jobs. The system is controversial and many people want it to be scrapped.**
- India is a former British colony; this has helped India become important globally due to the millions of people who speak English.
- There are 20 million Indian people living in over 100 countries (a diaspora). In 2014, they sent back $71billion in remittances. This is a very important source of income for India's economy.

How has the government and globalisation influenced economic change in India?

- In 1991 the government introduced 'Economic Liberalisation'. Before 1991 the government decided which industries produced what and where. Liberalisation changed it to a market economy where the 'market' decided:
  - What people will buy based on demand
  - Where goods can be made most cheaply
  - Where investment in products will make most profits
- Governments supporting a market economy encourage foreign investment and reduce or abolish:
  - Import tariffs.
  - Controls on how much money is brought into, or out of a country.
  - Taxes, especially on company profits.
- India is one of the few emerging countries that gives more aid than receives it. It gives to Sri Lanka, Bhutan and Nepal and still receives some 'technical assistance' from the UK.
- Globalisation has helped the economic growth as a result of India's connectivity.
- Containerisation and shipping developments have helped the trade of textiles, clothing and footwear from India
- India now produces more sophisticated and valuable items e.g. computer software and hardware.
- The low cost labour and high-level technology are attractive for Western countries.
- The tourism sector is growing rapidly – 39 million people are employed in tourism.

How TNCs operate in India (Outsourcing)

- BT have located their call centres in Bangalore.
- Indian graduates are paid £3000 a year (20% of what they pay in the UK).
- Call centre workers earn more than doctors and teachers so a 'brain drain' is feared.
- TNCs are attracted to Bangalore as the Indian government offers reduced taxes.
- The workforce are not only cheaper but also well educated and can speak very good English.
- The expertise in areas such as software development has encouraged Samsung, Microsoft and Intel to locate there.
- Communications technology like Skype can help BT and other TNCs have business meetings with India without having to fly their employees there.
- Other industries include Manufacturing (Toyota) and Aerospace (Boeing).
- Walmart (ASDA), Gap and Zara all use Indian labour to make their clothes as the minimum wage for garment factories is 87% lower than the UK.
- India has the second largest wireless network after China.

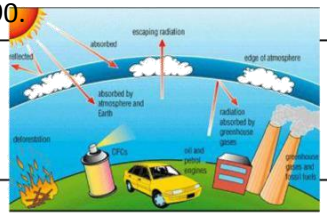
Economic impacts due to economic change in India

- Since 1991 (Economic liberalisation) TNCs were attracted to India. By 2015 clothing was India's largest manufacturing industry, employing 80 million people and earned $300 billion in GDP.
- People are willing to work 100-hour weeks for average wages of £35.
- No equal pay between men and women – 70% of garment workers are women on the lowest pay.
- The growth of IT in places like Bangalore has created increasing numbers of well paid 'middle classes' in India – estimated to be 200 million by 2020!
- India's economy has grown by 7% per year since 1997.
- India is likely to have the 2nd biggest GDP in the world by 2050.
- Between 1991 and 2014 India's GDP per capita went from $1150 to $5800.
- GNI per capita has risen from $2522 in 2000 to $5497 in 2014
- HDI has risen from 0.496 in 2000 to 0.609 in 2014.
- Agriculture is no longer as important to the GDP – fallen from 37.2% in 1980 to 14.5% in 2011.
- Manufacturing has fallen slightly from 16.9% in 1980 to 18.4% in 2011.
- Services have risen rapidly in importance from 45.8% in 1980 to 67.1% in 1991.
- Key exports are now petroleum products, gems and jewellery, pharmaceutical products and transport equipment. Over 50% of exports go to Asia.
- Key imports are oil, gold and silver and electronic goods. The largest source of imports are from China.
- FDI is increasing with over $250 billion worth of investment into India from foreign companies like BT and over $120 billion worth of investment overseas by Indian TNCs like Tata.

Social impacts due to economic change in India

Urban expansion increases the number of single professionals living alone.

- Large scale rural to urban migration is occurring but the level of urbanisation is way behind the global average (India – 32.7% in 2015, World – 54% in 2015)
- For educated urban women, they choose to develop a career and marry later. As a result, birth rate has fallen from 30 (per 1000) in 1991 to 19.9 in 2014. Also, fertility rate has fallen from 4 in 1991 to 2.5 in 2014.
- Life expectancy has increased from 60 years in 1991 to 68 in 2014.
- India's infant mortality rate has fallen since 1991 by over 50%.
- Average no. of years in school has increased from 2.4 in 1991 to 12 in 2011.
- 40 million people live in urban slums in India.
- India's population was 1.25 billion in 2015. This has increased by 48% since 1990.



Environmental impacts due to economic change in India

- Air pollution reduce life expectancy by 3 years for the 660 million urban residents in Indi
- Delhi is the most polluted city in India
- 275 rivers in India are polluted with sewage
- Deforestation is becoming a major problem with the ever-rising demand for forest-based products
- In 2014 the Indian government stated that 25% of India's land is experiencing desertification.
- 68% of the country is prone to drought.
- India is the world's third largest emitter of carbon dioxide – due to it being heavily reliant on coal.
- India is looking to create a carbon sink by planting large areas of forest.
- Climate change is a big threat to India's economy. The increasingly erratic monsoon rains threatens the farming sector worth $370billion and hundreds of millions of jobs.

Unequal development – Regions

Maharashtra - GDP per capita $2561 (2014) – India average = $1627 (2014)

- Maharashtra's economic growth has come from:
- **Service industries** - e.g. banking, IT, call centres (see section 2.10).
- **Manufacturing** - half of Mumbai's factory workers make clothing. Other industries include food processing, steel, and engineering.
- Its **port,** which is the second largest in the country.
- A booming **construction** industry, building factories and offices.
- **Entertainment.** Mumbai hosts the world's largest film industry, Bollywood.

Bihar – GDP per capita $682 (2014)

- Part of the 'rural periphery'
- 86% of its population is rural. Many are subsistence farmers, trapped in a cycle of poverty, shown in Figure 4.
- Half of its households earn less than 80p a day, and 80% work in low-skilled jobs.
- Even with 100 million people, Bihar gets little investment, because people can't afford basic services - only 59% of its population has electricity.
- Bihar is also a traditional caste-based society. Those in higher castes are literate, whereas those in lowest castes are mostly illiterate. It is difficult for someone to marry outside their caste, so it explains why those who are poor stay poor.
- School attendance is low. Only a third of children complete primary school, and 2% reach Years 12 and 13. Overall, literacy in Bihar is 47%.
- Women are poorest in Bihar, and have India's lowest literacy rates (33%). They rarely own land, and most are low-wage labourers.

A top-down project – The Narmada River Scheme

The Sardar Sarovar Dam on the Narmada River. It is one of the world's largest dams. When complete, it will store monsoon rains for use during the dry season. Originally, 80 metres high, the government plans to raise it to 163 metres to increase its capacity. The dam has been funded by IGOs – which involves governments and agencies working together. The Dam was funded by the World Bank, Japanese Banks and the Indian government.

Who benefits?

- **India's cities.** The dam is multipurpose, providing 3.5 billion litres of drinking water daily and hydroelectric power (HEP).
- **Farmers** in western India. A network of canals will irrigate 1.8 million hectares of farmland in Gujarat, Maharashtra, Rajasthan and Madhya Pradesh. These states suffer drought-causing loss of crops and animals each year.

Who loses?

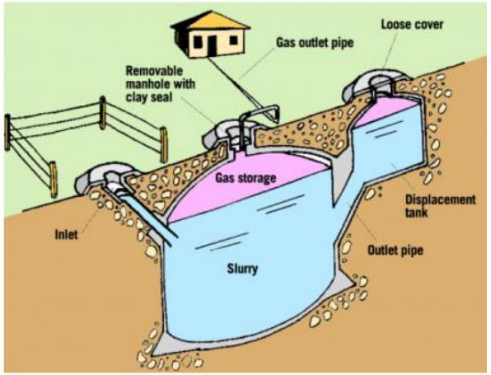
- **Local residents.** 234 villages have been flooded by the dam, forcing 320 000 people out. Few rural families can afford electricity from the scheme - only cities benefit.
- **Local farmers.** Good quality farmland has been flooded. Damming the river means that fertile sediment, deposited on flood plains each year, is also lost.
- **Western India.** Religious and historic sites have been flooded.
- **People downstream.** The region has a history of earthquake activity. Seismologists believe that the weight of large dams can trigger earthquakes, which could destroy the dam and cause massive loss of life.

A bottom-up project: Biogas

- Cow dung is a valued resource, because it produces gas, called **biogas.**
- The gas is used for cooking by day, and powering electricity generators at night.
- The dung is fed into a brick, clay or concrete-lined pit that forms part of a biogas plant.
- The pit is sealed with a metal dome and the dung ferments to produce methane. As pressure builds, methane is piped into homes.
- It is simple, uses local materials, and is an example of **intermediate technology.** It uses little space, uses materials available in India, and can be located in a village without impact.
- By 2010, four million cattle dung biogas plants had been built in India. These created 200 000 permanent jobs, mostly in rural areas, as well as other benefits:
- Unlike firewood, cooking with gas produces smoke-free kitchens so there are fewer lung infections.
- Heat is instant, so cooking is quicker.
- There is no ash, so there is less cleaning.
- No longer is time spent gathering wood or dung, so girls now have more time to go to school.
- Cattle are now kept in the family compound, making dung collection easier. Previously, cattle would graze local woodland, eating saplings and preventing trees from regenerating.
- When cattle dung is fed into the digester, micro-organisms that cause disease are destroyed as the dung ferments.
- After digestion, the sludge is richer in nutrients than raw dung, so it makes a better fertiliser.
- Many villages now use biogas to power electricity generators that provide light at night and pump drinking and irrigation water from underground. Farmers can now get three crops of vegetables a year using pumped water.

India – Which way next?

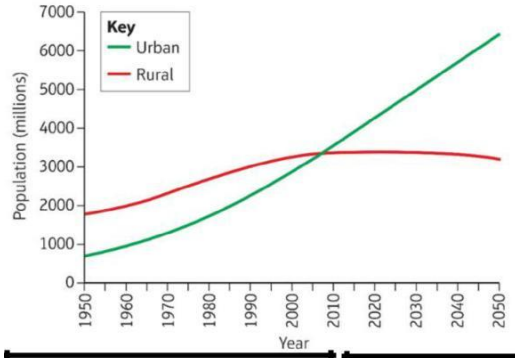
- India is now a major international player
- It is part of the emerging country groups called the BRICS (Brazil, Russia, India, China and South Africa)
- The BRICS account for 42% of the world's population and ¼ of the global GDP.
- India is a member of the G20 (alongside the UK, USA, France, Germany etc) and also supports the World Bank and Asia Development Bank.
- India wants to be a permanent member of the UN Security Council and more global organisations such as the IMF and WTO.

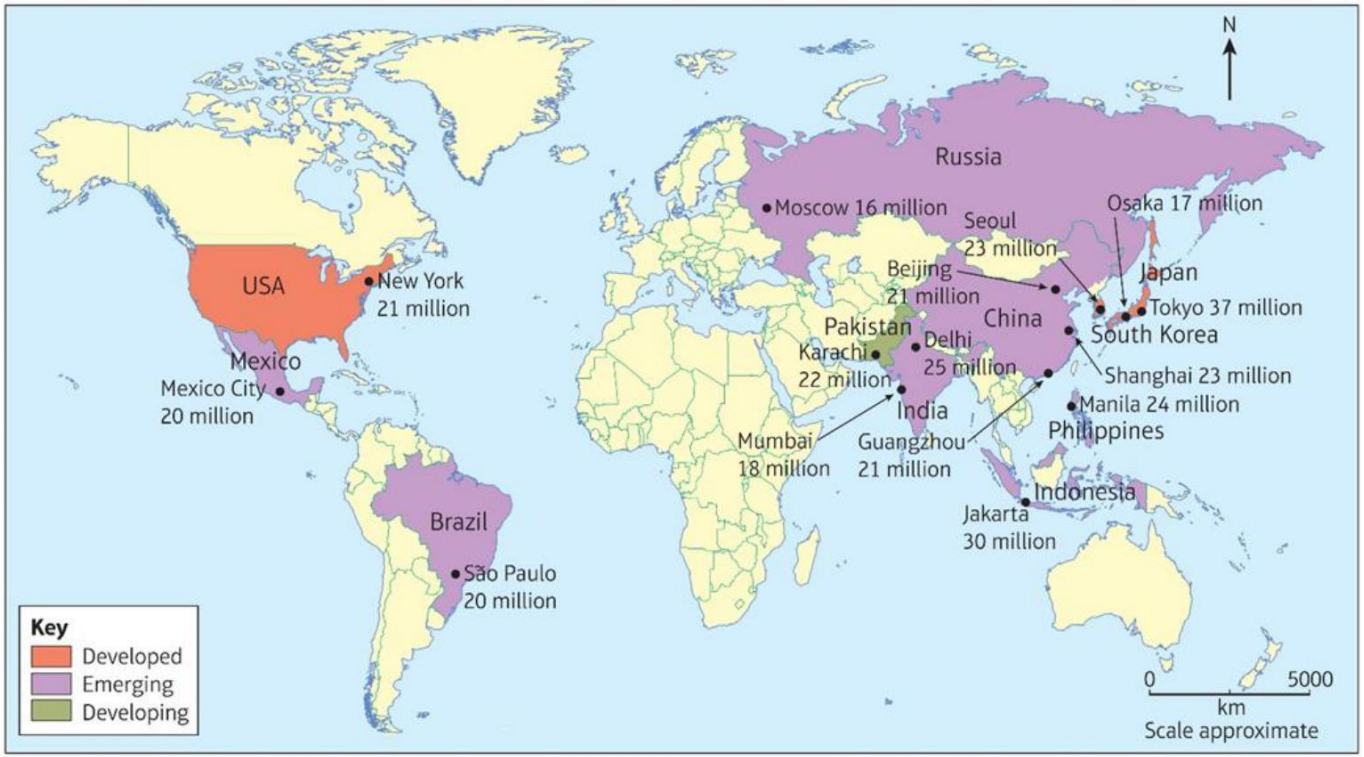


The World is becoming increasingly urbanised

(Past and current trends in urbanisation, variations between regions and projections, patterns of megacities and disproportionate economic and political influence)

- Urbanisation is the process by which an increasing percentage of people live in towns and cities. It is mainly caused due to migration from rural areas. Urbanisation is more prominent in emerging and developing countries. By contrast the urban population in developed countries will grow less. Demographers make projections of what they think will happen in the future. Most agree that urban areas will increase and rural areas will decrease.
- Urbanisation in developed countries—The growth of urban areas in developed countries was a result of the industrial and agricultural revolutions in the 18th and 19th centuries. At this time people moved from rural areas to the urban areas to gain work in factories. Urbanisation has been slow and over a long period of time. It has remained steady in developed countries since the 1980s.
- Urbanisation in emerging and developing countries—The growth of towns and cities in emerging and developing countries has been rapid and has taken place over the last 50 years. More people are moving in than the city can accommodate for. This is due to rapid population growth and lack of jobs in rural areas. The reason for the differences is that in developed countries most people already live in urban areas. Another reason is that developed countries have a low natural increase rate. Developing countries have a high rural-urban migration rate and natural increase rate.
- Megacities—These have a population of 10 million people or more. Major cities have populations of 200,000 or more. The 1st megacities were in developed countries such as New York, Tokyo, London and Paris. Today, the fastest growing megacities are in developing or emerging countries. They are often poor cities with a young population, attracted from the rural areas.





Key Terms

Urbanisation
Emerging countries
Developing countries
Developed countries
Projection
Megacities
Major cities
Primate cities
Socio-economic processes
Natural increase

Questions

1. What is a megacity (1)
2. Explain what primate cities are and why they have grown so big (4)
3. Explain the distribution of emerging and developing cities (4)
4. Explain why people are moving from rural to urban areas (4)

Key Terms

Formal employment
Informal employment
Urban economies
Pre-industrial
Post-industrial
Industrial
Clark-Fisher model
Pull factors
Push factors
Rural-urban migration

Formal and informal employment

People who work in formal employment usually receive a regular wage and may pay tax on their income. In some countries they may have certain employment rights, such as sick leave or holiday pay. The formal employment sector includes factory workers, office workers, shop keepers and governments.

Informal employment activities are not officially recognised by the government. They generally work for themselves e.g. hairdressers. They don't always pay taxes and have no protection.

Questions

1. Explain two differences between formal and informal employment (4)
2. Describe the main differences between the economies of cities in developing and emerging countries and economies in developed countries (4)
3. Explain why the informal sector creates issues for governments (4)
4. Explain why international and national migration have contributed to the decline of a major city in the developed world (4)
5. Explain two of the pull factors that attract people from other countries to migrate to London. (4)

The impact of migration on urbanisation—

National migration—This is migration that occurs within a country. In 1990, Chongqing in China had a population of 2 million. By 2014, the population was 12.9 million due to large scale internal migration. This was caused by: economic reform in China, the rapid growth of industries after 200, loss of farmland due to urbanisation. Migrants were attracted to the cities due to more opportunities and better services such as healthcare and education.

International migration—This is migration between 2 different countries. In 2001, London had a population of just over 7 million people. In 2011, the population had increased by 14% to 8.1 million. This is largely due to migrants from India, Poland, Ireland, Nigeria and Pakistan. The pull factors that attracted the migrants to London were employment, entertainment and culture, services and UK international transport network. Push factors also encouraged the people to migrate from their country of origin such as lack of jobs, healthcare, standard of living and potentially war.

Urbanisation is a result of socio-economic processes and change. (migration, national, international, urban economies, type of employment)

Features	Formal Employment (E.g. Industry—car manufacturer)	Informal Employment (E.g. street seller)
Scale of activity	Large scale—Usually in a factory	Small scale– maybe on a street corner
Level of skill	High level skilled work	Low level skills
Ease of entry	Needs a lot of funding and equipment to get started.	Needs little funding or equipment to start
Need of capital	Needs a lot of capital to get started and is often funded by governments	Needs little capital to start
Number of workers	Often more than 100 workers	Usually a few workers who are generally unemployed
Working conditions	Workers have protection to ensure the environment is safe e.g. accident prevention policies. Usually there are set working hours and some have trade unions to ensure good working conditions.	No protection for workers. No set working hours, may have to pay protection to gangs. There are no trade unions to support workers.
Location	Factories	Home or on the street
Taxes	Pay tax to the government	Pay no taxes

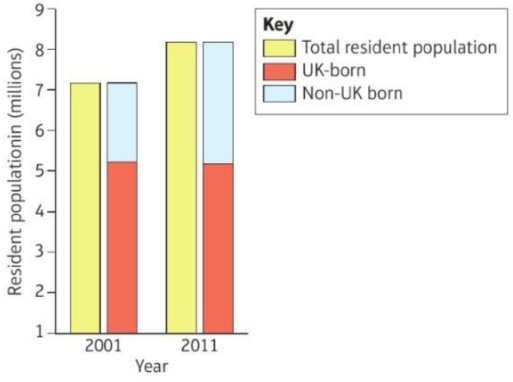


Figure 4 Population of London, 2001 and 2011

Impact of economic change on urbanisation—

Growth of cities—Economic change can lead to urbanisation. For example, Sao Paulo in Brazil. In 1960 it had a population of 6 million, this rose to 12 million in 1991. In 2014 the population was 20 million. The reasons for this were: the modernisation of agriculture, decline of primary industry to rise in tertiary, the closure of secondary industries. Socially the city had a high birth rate and low death rate so the population had a positive natural increase. As well as this Sao Paulo offered good services such as health and education.

Decline of Cities—When a city is dependent on one major industry for its economic prosperity, it becomes vulnerable to changes. In the USA, Detroit was home to a successful car industry. At its peak in 1950, 1.8million people lived in Detroit. But by 2013 this fell to 700,000. Competition from car makers in Japan, Germany and South Korea outsourced the industries in Detroit. Sales of US-made cars and trucks declined, costs rose and the industry failed to introduce new technology quick enough. The factories couldn't compete so factories closed, people lost their jobs and the population migrated.

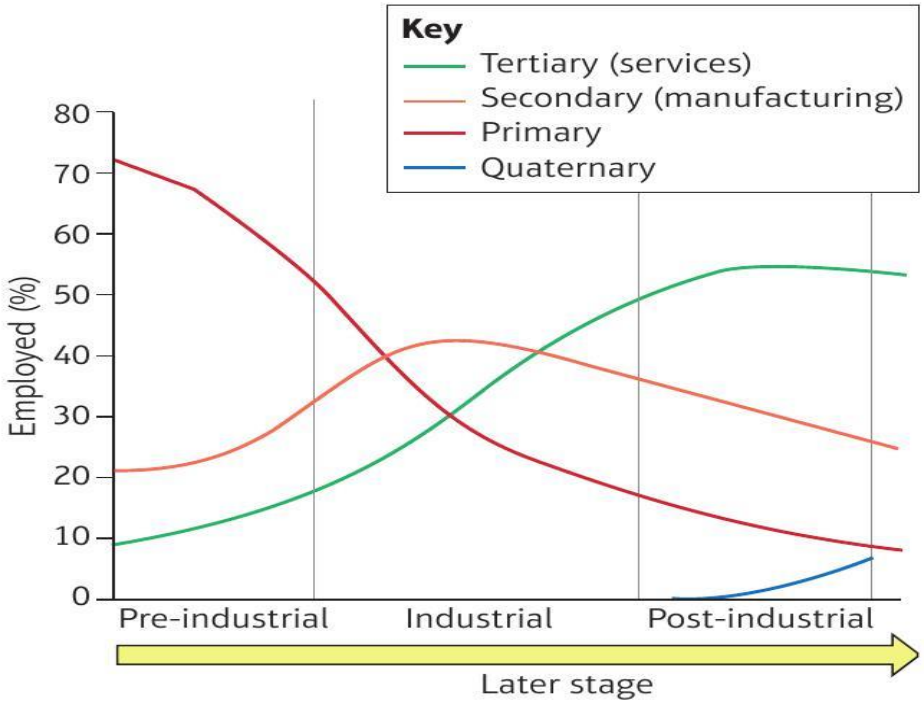


Figure 6 The Clark-Fisher model

Differences in Urban Economies

The developed, emerging and developing countries are at different stages of economic development, which is reflected in their urban economies. The Clark-Fisher model of changing employment helps us determine the stage of economic development of a country. These stages are:

- Pre –industrial—most jobs are in farming, mining and fishing.
- Industrial—manufacturing industry and towns grow rapidly. Some tertiary employment provides services such as transport, water and electricity.
- Post-industrial—tertiary sector becomes most important. Demand for services, especially in towns, fuels and increase in health and financial services.
- Later stage—quaternary sector develops, especially research and development.

Developed—e.g. London and Paris	Emerging—e.g. Mexico City and Mumbai	Developing e.g. Lagos
• Usually have a broad range of jobs and industries: • Little if any primary industry • Secondary industries such as engineering and printing • Many tertiary industries such as tourism, education, finance, health and other services. • Quaternary industries such as ICT, media, consultation and culture, as well as top-level decision making.	• Little primary industry Manufacturing that processes primary products, such as sugar refinery or heavy industry such as engineering. • Very large tertiary industries, including government administration, and service industries such as tourism, transport and entertainment. • Smaller quaternary sector, which is growing rapidly.	• Little primary industry • Secondary industry that often processes primary products, such as textiles, sugar refining and flour milling. • Very large tertiary industries, including government administration, and service industries such as tourism, transport and entertainment. • Small initial quaternary sector which is growing.

Key Terms

Urbanisation
Suburbanisation
De-industrialisation
Counter-urbanisation
Regeneration
CBD
Accessibility
Availability
Planning Regulations

Questions

1. Define urbanisation (2)
2. Define regeneration (2)
3. Explain how accessibility and cost influence urban land use (4)
4. Explain some of the main factors that influence land use in a city (4)

Cities change overtime and this is reflected in changing land use

(How population, distribution changes overtime, characteristics of urban areas)

The number of people living in a city, where they live within the city and how the city shapes itself all change over time. A city may go through each of the following stages:

- Urbanisation—In the most developed countries, such as the UK and USA, urbanisation was linked to industrialisation. The industrial revolution and services such as railways, roads and a safe water supply attracted workers to the growing towns. As cities become urbanised, more factories were built and growing numbers or rural migrants arrived to fill the jobs that were created.
- Suburbanisation—By the early 20th Century in developed countries, city centres had become noisy, crowded, polluted places. People who could afford to, moved out of the city centre to the new 'suburbs' on the edge of the city where land was cheaper and the air was cleaner.
- De-industrialisation— The industry in the city begins to decline. Often this is the result of technological change, failure to invest or competition from other countries (outsourcing).
- Counter-urbanisation—In the 1970s - 1980s, people in the UK, Europe, USA and Japan chose to leave larger towns and cities to move to more rural areas. This led to a pattern of population decline in inner city areas and population growth in small towns and villages. Counter-urbanisation was possible due to increased car ownership and motorway construction, this allowed people to commute to work. Progress in telecommunications and information technology also meant that people could work from home in remote villages.
- Regeneration— Some older cities have started to redevelop their run-down inner-city areas in order to attract people to live close to the amenities of the city centre. New shopping centres, flats, houses and leisure facilities are built to give the city centre a facelift and attract businesses.

Factors influencing land use:

- Accessibility—Shops & offices need to be accessible to as many people as possible and so are usually found in city centres, which have good transport links. Sometimes, the edge of the city is most accessible, often by motorway and this has led to the growth of out-of-town shopping centres, which are multi-use.
- Availability– City centres tend to be heavily built up. The availability of land may also affect how land is used. When factories close, the brownfield site may be used for housing, shops and offices.
- Cost– Land in the city centre is often very expensive due to a lack of availability. Some land-uses such as shops and offices, can afford to pay high rents.

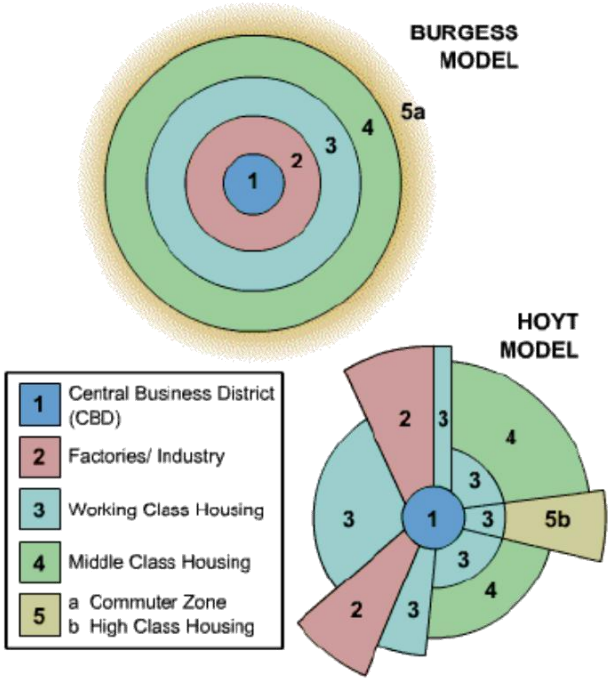
Similarities and differences between developed, developing and emerging countries:

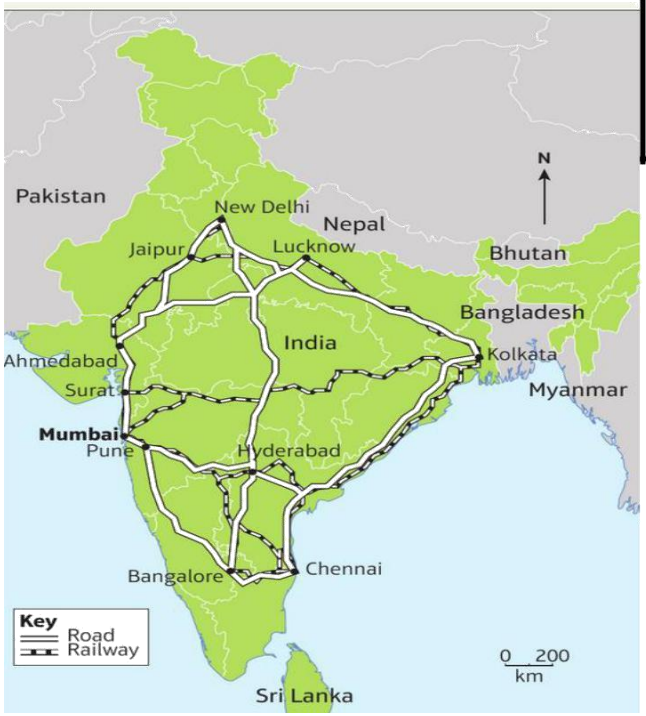
- Similarities: Most cities have a CBD, have areas with industrial zones and are spread over a wide area. They have extensive suburbs They have issues with pollution and traffic congestion.
- Differences: The zones of industry and housing are more distinct and separate in developed countries. In developing and emerging countries affluent areas are close to industrial zones or areas of squatter settlements. Most cities in developed countries do not have squatter settlements. Cities in emerging and developing countries have not experienced counter-urbanisation.

Why functional zones form in cities?

The centre of a city is the most accessible part of the city. Most land uses that need access to lots of people, such as shops and offices, must locate near the most accessible part. So there is competition between land uses. This means the rent charges for the city centre are higher, therefore only those who can pay the high rents can afford to locate there. Shops and offices can afford this, other land uses like manufacturing and industry are found further away from the city centre where there is cheaper land. Land use zones

- Planning Regulation—Planning also affects land use patterns. Planners try to balance different, often competing for land. The city's authorities often decide how they want a city to look and develop and plan on what type of land use is permitted in certain areas.





CASE STUDY—The location and context of Mumbai Megacity –influences, structure, growth & function

(Site, situation, connectivity, structure, functions)

Mumbai is India's biggest city. It has a population of 12.5 million people living within the city limits, which makes it a megacity.

Mumbai's site explains why people first settled here on a number of islands next to a safe harbour. Its situation explains why a small fishing village surrounded by mangrove swamps developed into a port city and an industrial city. It has a naturally deep harbour, accessible for container ships and it is located on the west coast of India, facing important regional markets such as the Middle East and international markets in Europe. The docks in Mumbai account for 25% of all India's international trade. Mumbai is also well connected to the rest of India through extensive road and railway networks. This means people can easily travel to and from Mumbai across India.

Industrial history—Britain was important to Mumbai's industrial development. In the 19th Century Britain imported cotton from India. This helped develop rail networks to Mumbai's port. Britain then developed textile industries in Mumbai this led to population growth as people come from across the region to work in the factories. By the late 20th Century, Mumbai's textile industries started to decline as did the port. However, other industries started to take its place such as banking. Banking has always been important in Mumbai and is one of the world's most important financial centres as globalisation connected economies around the world. Many of India's biggest companies moved their headquarters to Mumbai. Engineering, healthcare, pharmaceutical and IT industries grew fast. 'Bollywood', the Hindu-language film industry, also developed in Mumbai. Its importance as an entertainment and media centre makes Mumbai culturally significant in India today.

Site Problems– By the end of the 20th century, Mumbai's population was growing very rapidly, fuelled by rural-urban migration. Mumbai could only expand North up its long narrow peninsula making it very crowded and unsanitary. In 1970 a proposal was made to develop a new suburb of Mumbai on the mainland. In 1980-90 the population of the island city of Mumbai declined slightly as New Mumbai expanded rapidly.

Questions

1. What are the two main factors that cause megacity growth in an emerging country like India? (2)
2. Explain the distribution of the slums across the city (4)
3. For a named megacity in a developing or emerging country, explain one way in which its location has affected its growth, function or structure (2)
4. Explain how Mumbai's connectivity has fuelled the growth of its economy and population (4)
5. Explain the difference between Mumbai's site and situation (4)

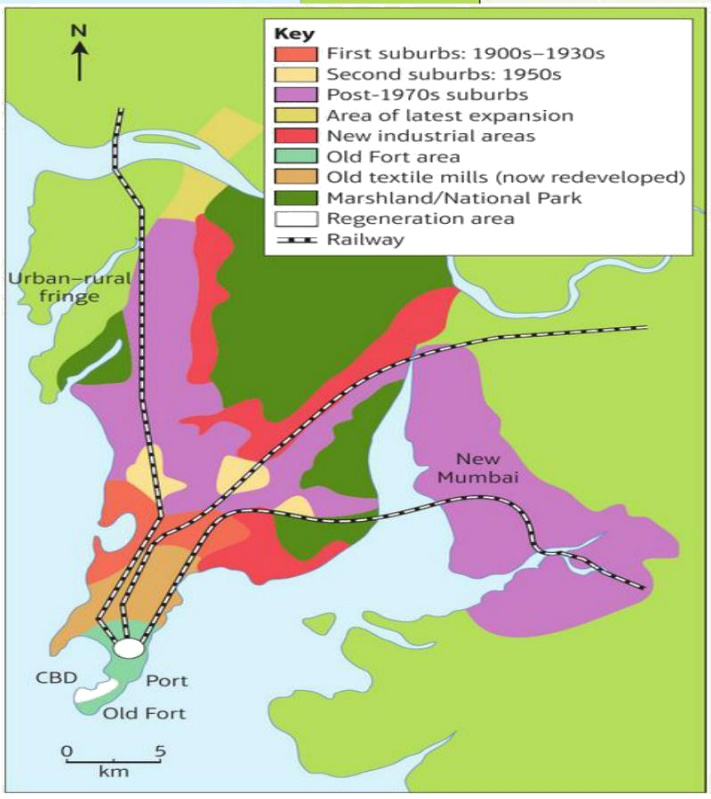
Key Terms
Site
Situation
Environmental factors
Structure
Function

Environmental factors:

In the north of Mumbai's peninsula is the Sanjay Ghandi National Park. This is the world's largest park in a city (100km² forest) which attracts 2 million visitors a year. The park has a small population of tigers. It is located on high steep ground preventing urbanisation. Locals believe that it improves the air quality of the city.

How has Mumbai's structure developed?

1. Urban-rural fringe– Mumbai's urban-rural fringe is hard to locate because it has spread out into a vast conurbation merging into other towns on the mainland with a population of 22 million people. Rural areas are generally found where the environmental factors around Mumbai mean the land is not suitable for building. For example: Marsh land, the National park area and floodplains.
2. Outer suburbs– This second area of suburbs was developed post-1970s as the settlement developed along the railway lines. This allowed commuters to travel into and out of the city every day. New industrial sectors have now developed along the railway networks as well. New Mumbai was planned as a low density suburb where lower land prices could create a better quality of life, with less congestion for the commuters. Due to the cheap land prices, more space to expand and availability of skilled worker's industries relocated to New Mumbai from the peninsula.
3. City-Centre—The oldest parts of Mumbai are at the Southern tip of the peninsula. The CBD is located here, centred on the old banking sector of the city. The headquarters of important companies are located here such as Bank of India, Bank of America, Cadbury India, Microsoft India, Tata, Volkswagen and Walt Disney. The old textile mills area has been redeveloped. The housing located here is extremely expensive due to its proximity to the CBD. Retail developments such as shopping malls are also found here. The port is still very economically active, as thousands of people work here and live in slum housing.
4. Inner suburbs– This area was developed to house workers in the old textile mill area. Most of this area is now characterised by squatter settlements and slums such as Dharavi, Asia's largest slum.



DID YOU KNOW:

- Mumbai is India's economic powerhouse and a city that is important on a global scale.
- Mumbai generates more than 1/6 of India's GDP.
- 10% of all India's industrial jobs are located in Mumbai in a wide range of different industries.
- 40% of India's exports come from Mumbai and is India's top location for FDI.
- Mumbai has India's busiest international airport and India's 2 largest stock exchanges.
- There are 10 universities and many research centres specialising in IT and engineering.

CASE STUDY—Mumbai is rapidly growing

(Reasons for population growth and how it has affected the pattern of spatial growth and changing urban functions and land use)

Mumbai's population has increased by more than 12 times in the last 100 years. After 1970 most of the growth was not in the old island city of Mumbai as this was already too congested. Instead the suburbs grew the most. Population density for the city it is 20,962 people per Km² (one of the highest in the world). This makes living space very expensive and the city very congested. This means people and businesses try to relocate to less congested areas. They generally move along railways and road networks. Some rural-urban migrants have almost nothing, they can't afford to travel to work or afford rent. This leads to the development of slums, here the population density is very high, however the slums are close places where people can work and accommodation is cheap. Generally, slums are located next to expensive accommodation. Megacity growth in an emerging country such as India is due to two main factors:

- National/ international migration - The boom in Mumbai's population growth from the 1970s onwards was fuelled by migration (mostly rural– urban migration) from the region and around Mumbai.
- Rates of natural increase - From 2001-2011 the population increased by 3.4 million in the conurbation as a whole, around half of this increase was due to migration into Mumbai and half due to natural increase. In the old city centre, natural increase added 750,000 to the population, however 250,000 moved out during this time. The suburban district population increased by over 1 million people, mostly due to internal migration.

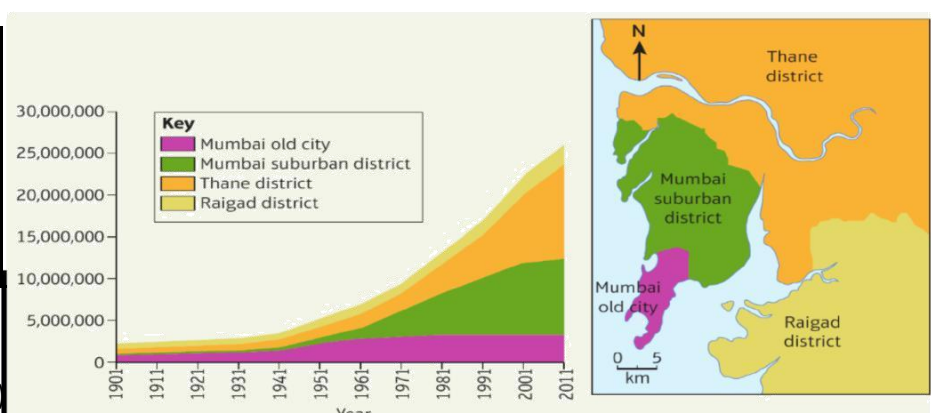
Key Terms

Population density
Natural increase
Push and pull factors
Economic growth

Questions

1. Identify one industry that has been important in Mumbai's development as a megacity (1)
2. Explain the reasons for rural-urban migration (2)
3. Explain the reason for the population decline of Mumbai's old city in the last 10 years (4)
4. Explain the relationship between Mumbai's economic growth and its population growth (4)
5. Explain the push and pull factors affecting Mumbai's population growth (4)

Push Factors	Pull factors
Difficult rural conditions Few services in rural India Lack of education and healthcare New farming techniques meaning fewer jobs	Huge range of jobs Education opportunities Range of healthcare options Wages are much higher



CASE STUDY—Mumbai's population growth creates opportunities and challenges

(Opportunities, Challenges, Reasons for differing qualities of life)

Opportunities

The rise of the service sector— Jobs in manufacturing such as cotton manufacturing and car production is what encouraged rural-urban migration throughout the 20th century. By the 1980s these industries declined and Mumbai's economy witched to the service sector. Finance and IT services employed the most Mumbaikars. Foreign direct investment due to globalisation meant that IT and finance industries brought in more international migrants to live and work in Mumbai. Other service sector industries developed as well such as taxi driver services, cleaners, hairdressers, mechanics, waiters and street vendors. The main opportunity brought by urban growth is employment, especially for those living in rural regions. Even if the living standards are poor, the opportunities for work are so high it encourages many to move. Dharavi industries—Dharavi is located between two major railway lines. It has a population of 1 million people in 1.5km²and is home to 5000 small-scale businesses and 15,000 single-room factories. These businesses provide £350 million per year. This is a result of poor people creating their own opportunities as they cannot afford Mumbai rent outside the slums.

Infrastructure benefits—Even when people live in slums like Dharavi, megacities provide many services and resources that cannot be found in rural regions. Such as electricity, schools and hospitals. 6million people live in slums in Mumbai (40% of the population). More than 1 million Mumbaikars earn less than £10 a month. However, media companies realise they can still earn profits from poorer people by charging them £1-2 a month for TV access.

Challenges

- Rapid expansion—Population growth has occurred faster than services can develop. This has created challenges such as reliable electricity supplies and adequate water supplies. As well as this it has created huge pollution issues as the government struggles to organise waste disposal. There are an estimated 800 million tonnes of untreated sewage in the river.
- Traffic congestion— There are over 1.8 million cars in Mumbai due to a rapid rise in private cars. Roads are often gridlocked. 90% locals travel by rail rather than car; however, this has strained the railways (8 million travel on the suburban lines each day).
- Housing—Finding affordable housing is extremely hard due to limited space. As the city spreads so does the population and density. There are 2 main types of housing in Mumbai. One type is Chawls (old tenement buildings over 100 years old) They are very overcrowded and aren't maintained. The second type is Squatter settlements; this is when people put up market huts on land owned by other people or the government. The poorest people live on the streets, under bridges and on sidewalks. Sometimes it is temporary but for others it's a way of life. Some business owners try and charge people for sleeping on their pavement. Over 20,000 live this way.
- Living with slums—People live in slum conditions as they can get to work easily and rent is cheaper. However as squatter settlements are not official government or council locations the government doesn't have to provide them with infrastructure or services. This provides many problems such as: lack of adequate water (generally there are stand pipes which only give out water from 5.30am to 7.30am), sanitation issues (there are no sewage systems so people defecate in the streets, streams and rivers that run through the settlement. When there is a latrine more than 500 people could share the same toilet at a price). Another issue with a lack of fresh clean water is that families have to clean in the rivers and streams they pollute. A big issue for Mumbaikars is the value of the land as the government and businesses have started clearing squatter settlements for property developments and new businesses. The government wants to provide better services, infrastructure and facilities for locals and businesses. However, when the homes are cleared families are made homeless.
- Working conditions– Most employment is in the informal sector, this means there is no protection for workers. The working conditions are generally very poor with limited light, workspace, breaks, ventilation. Toxic fumes can fill factories; work can be dangerous for little pay.

Quality of life (QOL)—is measured according to different factors such as wages, how people feel, services. There is no standard way to measure quality of life which can make it difficult to compare cities and countries quality of life. QOL in megacities is generally measured according to: level of air and water pollution, transport congestion rates, access to healthcare and education, crime levels, access to affordable housing, sanitation, quality of government services and income.

QOL in Mumbai— Although this city is globally important it lacks a good QOL. Other emerging Asian countries have much better QOL in terms of housing, pollution, healthcare and sanitation. Given Mumbai's great wealth and FDI its quality of life makes it a difficult place to live and work. There are 3 main problems for Mumbai. Problem 1 is the government is inefficient and bureaucratic which means it takes a long time for infrastructure improvements to be approved. Problem 2 is most of Mumbai's properties are rent-controlled, meaning there is a limit to how high rents can be. This discourages property owners from improving their residencies and redeveloping. The 3rd problem is corruption. The areas that were meant to be redeveloped into affordable housing such as the old textile mills were sold to property developers who built expensive apartments that only the rich can afford.

Mumbai differences in QOL— Approximately 40% of Mumbai's population live in squatter settlements, 20% live in Chawls, 10% on the streets and 30% or less who live in apartment buildings, flats or bungalows. Over 60% of the population work in the informal sector, meaning they can only afford to live in Chawls or squatter settlements. Generally, the slums are located next to areas with good QOL.

Reasons for differences in QOL—The main reason is due to rapid expansion. Other reasons are that to improve access to affordable housing, more houses will need to be built, however more money can be made by building expensive apartments. A second reason is to improve working conditions in the informal economy new laws and regulations will need to be put into place. Thirdly to improve access to services, the city government would need to incentivise more companies to provide services in poorer areas.

Political and economic challenges of managing Mumbai—To improve QOL difficult economic and political decisions have to be made such as whether to clear slums for development, traffic congestion is a huge issue, however it is too expensive to improve and the government gets no taxes from the informal sector, which the government could use to improve QOL however it would be hard to change as locals would feel they are losing money.

Key Terms	Questions
Service sector Globalisation Quality of life Congestion	Explain how population growth has created opportunities for the majority of Mumbai's residents (4) For a named megacity in a developing/ emerging country, explain two reasons why rapid population growth has led to problems with traffic congestion (4) Explain how population growth has led to challenges for Mumbai's residents (4) Explain the relationship between rapid urban growth and urban inequality (4)

CASE STUDY—Quality of life can be improved through different strategies (Sustainable, Bottom-up, Top-down)

What are sustainable cities?

A city that provides a good quality of life for all its residents without using up resources in a way which would mean future generations would have a lower quality of life. In a sustainable city there would be good public transport systems to reduce congestion and improve air quality, waste would be recycled, the residents would be energy efficient so less pollution is made. Everyone would have access to good services such as healthcare and education as well as affordable housing.

Top down strategies to improve quality of life

These are big, expensive infrastructure projects generally developed and managed by governments. There would be multi-billion dollar funds city governments can access to pay for the projects. They are known as top down as they are generally imposed on the people by the government.

The Mumbai Monorail

The government decided in 2005 that a mono-rail would be a good solution to traffic congestion.

Advantages

- Reduces the amount of traffic on the roads making them safer
- Constructed over built up areas without having to clear any roads/land.
- Carries passengers quickly and easily moves around the landscape
- Government created a public-private partnership by 2008 with foreign engineering companies who provided their expertise.
- Tickets are cheap (11 rupees per person –10p),

Disadvantages:

- Construction began in 2009 with a deadline of 2011 - only opened in 2014.
- The cost of the 1st section was £310 million.
- Number of passengers has been lower than expected - Only 15,000 each day
- Mainly used by tourists due to its location away from the main city.

Vision Mumbai Top Down

The city government is eager to use top-down strategies by selling the land to developers on the understanding that free housing is provided for the slum dwellers whose houses have to be cleared. The catch is that they have to have proof that they have lived in Dharavi since 2000. The redevelopment scheme aims to build 1.1million low cost, affordable housing, provide water and sanitation services for residents and provide education and healthcare services as well as retail and leisure services. However, the residents are extremely opposed to the plans. They are concerned that it would not be possible for them to run their small-scale businesses and micro-industries such as pottery and mechanics in apartment blocks. As well as this the new housing blocks would destroy the strong community bonds creating social issues and more crime.

Bottom-up strategies

Organisations work with local residents to create community based projects to improve the quality of life for residents. Most of the organisations are non-governmental

SPARC and community toilet blocks

Government toilet blocks that were provided charged individuals for each use, meaning they were too expensive for most families. The design of the toilets was also very poor, without running water and no employees cleaning them. An Indian NGO called SPARC works with communities to build new toilet blocks that are connected to city sewers and water supplies. Locals help to construct the toilet block and families from the community can purchase monthly permits for 25 rupees (25p) which is much cheaper than the government owned. Once they have a permit they can use the toilets as much as they want. The toilets have electric lights making them safer and separate toilets for children. In 5 years, 800 toilet blocks each with 8 toilets have been created. Although some argue it should be the government's responsibility to provide toilets not NGOs.

Hamara foundation

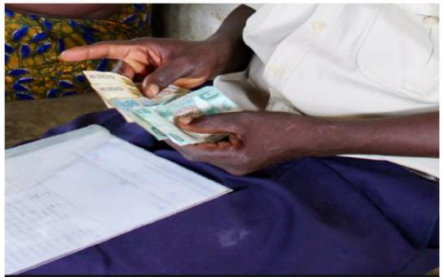
There is over 200,000 street children in Mumbai that have dropped out of school. Police force them to move from any shelters they have created as some street children steal and take drugs. The Hamara foundation creates social-work services for these children to help them get an education, improve their health and give them job skills. Between 2013-2014 327 children were supported by the foundation. This foundation also provides vocational training for 16-18 year olds in computing, mechanics and hospitality. The issue is not many children are being helped.

Agora Microfinance India

Squatter settlement residents usually struggle to have a bank account or get loans as they don't earn enough money. Microfinance is a banking service that helps provide microfinance (small loans—mainly for women) to slum residents to start businesses, improve their homes. There are also education loans available for people who want to take classes. Group loans allow people to take a loan together. Individuals can get a loan of up to £300 with an interest rate of 25%, paid in weekly instalments. Before a loan is given, a guarantor has to agree to pay the company £150 if the loan is not repaid.

Improving Dharavi's QOL

The location of Dharavi is said to be worth US$10 billion as it is close to the Bandra-Kurla Complex (a new business district), two railway networks and the main airport. The city government is eager to use top-down strategies by selling the land to developers on the understanding that free housing is provided for the slum dwellers whose houses have to be cleared. The catch is that they have to have proof that they have lived in Dharavi since 2000. The redevelopment scheme aims to build 1.1million low cost, affordable housing, provide water and sanitation services for residents and provide education and healthcare services as well as retail and leisure services. However, the residents are extremely opposed to the plans. They are concerned that it would not be possible for them to run their small-scale businesses and micro-industries such as pottery and mechanics in apartment blocks. As well as this the new housing blocks would destroy the strong community bonds creating social issues and more crime.



Questions

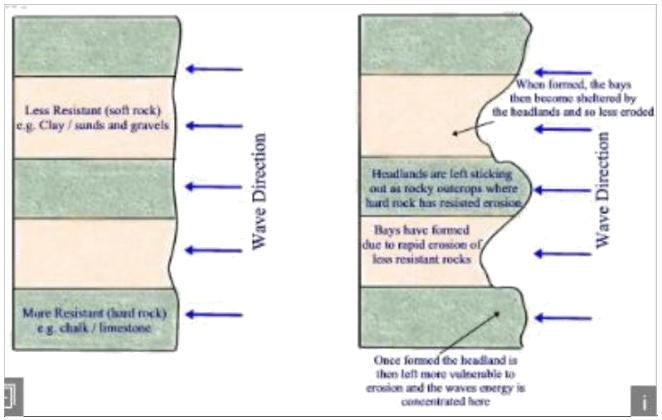
1. For a named megacity in a developing or emerging country, evaluate whether bottom-up solutions can improve the quality of life for residents (8)
2. Explain one top-down method in your chosen megacity to improve quality of life (4)
3. Explain the difference between a top-down and bottom-up strategy (4)
4. Assess which is more appropriate to improve water supply, transport services and air quality—top down or bottom-up and why? (8)

Key Terms

Sustainable
Top-down
Bottom-up
Microfinance
Advantages
Disadvantages

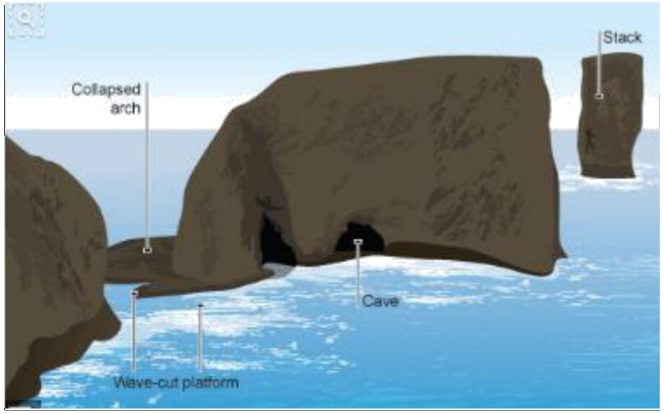
Topic 4A: Coastal Change and Conflict

Headlands and bays: Bays form due to rapid erosion of soft rock. Once formed bays are sheltered by headlands. Headlands are left sticking out where the hard rock has resisted erosion. Once formed however the headlands are more vulnerable to erosion. These are generally found along discordant coastlines.



Hard rock coastal landforms created by erosion:

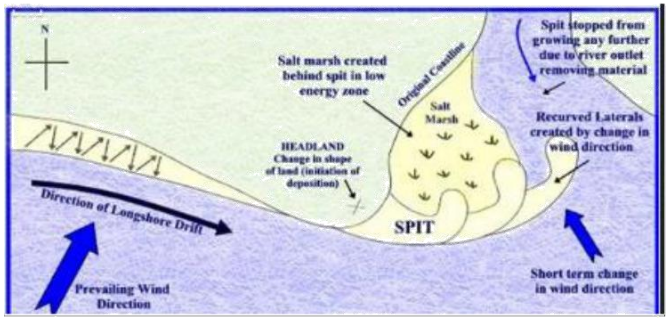
Caves, arches, stacks and stumps: A cave is formed when a joint/fault in a rock is eroded and deepens. This can then develop into an arch when two caves form back to back from either side of a headland and meet in the middle. When an arch collapses, it creates a stack. When a stack collapses it creates a stump.

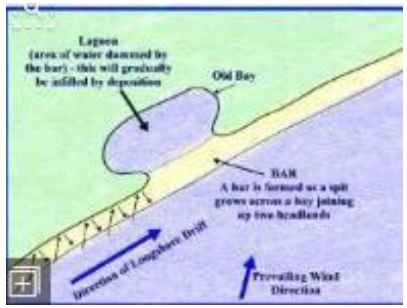


Depositional landforms:

Beaches—can be straight or curved. Curved beaches are formed by waves refracting or bending as they enter a bay. They can be sandy or pebbly (shingle). Shingle beaches are found where cliffs are being eroded. Ridges in a beach parallel to the sea are called berms and the one highest up the beach shows where the highest tide reaches. Spits– narrow projections of sand or shingle that are attached to the land at one end. They extend across a bay or estuary or where the coastline changes direction. They are formed by longshore drift powered by a strong prevailing wind.

Bars—form in the same way as spits, with longshore drift depositing material away from the coast until a long ridge is built up. However, bars grow right across the bay, cutting off the water to form a lagoon.





Exam questions:

1. Explain how a wave-cut platform is formed (4)
2. Briefly describe how spits are formed (2)
3. Explain the formation of a stack (6)
4. Explain how beaches are formed (4)

Hard rock coastal landforms created by erosion:

Wave-cut platform: A wave-cut notch is created when erosion occurs at the base of a cliff. As undercutting occurs the notch gets bigger. The rock will overhang the notch. The overhang will collapse and the cliff will retreat. This will create a wave-cut platform which is visible during low tide and submerged during high tide.

Transportation and deposition

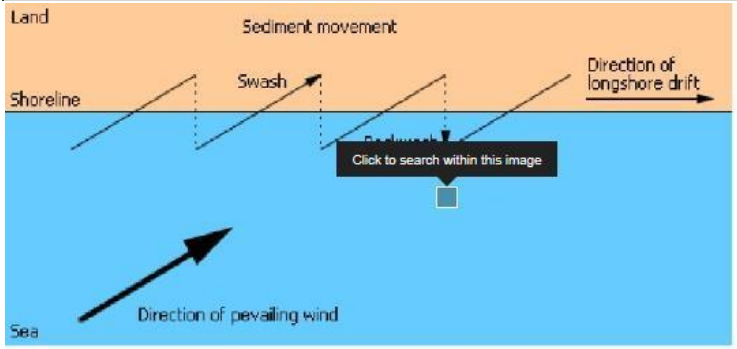
Longshore drift— Waves approach the sea at an angle, swash pushes material up the beach at the same angle as the prevailing wind. Backwash carries the sediment back down the beach at a right angle due to gravity. This moves material along the coasts. Traction– large boulders are rolled along the sea Saltation—smaller stones are bounced along the sea floor.

Suspension—sand and small particles are carried along in the flow.

Solution—some minerals are dissolved in seawater. Deposition - Waves drop the material it is carrying as it loses energy, it generally happens in sheltered areas such as bays, in calm conditions and with a gentle gradient.

Exam questions:

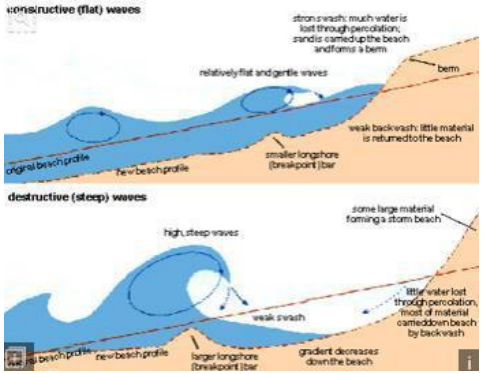
1. Identify two landforms that are characteristic of discordant coasts (2)
2. Explain how the UKs climate contributes to coastal erosion (4)
3. Describe two ways in which waves erode a coast (2)
4. Explain how geological structure can influence the erosion of a coastal headland (4)
5. Explain the factors that lead to a fast rate of coastal retreat (4)
6. Draw a diagram to show the stages of freeze-thaw weathering (3)
7. Describe the differences between a constructive wave and destructive wave (4)
8. Explain the process of longshore drift (4)



Types of waves:

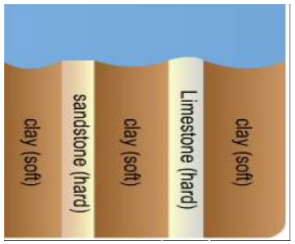
Constructive waves— Have a strong swash and weak backwash, small waves under 1m high. Encourage deposition.

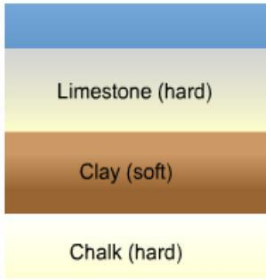
Destructive waves—Strong backwash, weak swash, taller than 1m. Encourage erosion.



Concordant and discordant coasts— Concordant coasts are made up of the same rock type, parallel to the sea. On discordant coasts have alternating rock types perpendicular to the sea forming headlands and bays.

Coastal retreat—when coasts move further in land as cliffs collapse into the sea due to erosion.





Rates of erosion:

This can be affected by: Geology, wave climate—fetch, direction, height, local currents and tidal range and groundwater levels—saturated cliffs are more vulnerable to erosion.

Three types of weathering:

Mechanical weathering— freeze-thaw is most common in colder climates. When the water freezes in joints and faults it expands and causes the faults and joints to widen and eventually break away.

Chemical weathering—this happens when the rocks mineral composition is changed. Granite contains feldspar which turns to clay when it reacts with water making it easier to erode. Limestone is dissolved by carbonation as it is alkali and sea water is acidic.

Biological weathering—Caused by plants and animals, this helps speed up erosion. Trees roots can cause cracks and faults to be created and bird poo (guano) can dissolve minerals in rocks.

Four types of erosion:

Hydraulic action—the weight and impact of water against the coastline and cliffs erodes them.

Abrasion—breaking waves throw sand and pebbles against the coast during storms.

Attrition—rocks and pebbles collide.

Solution—chemical action by sea water, dissolves minerals in rocks.

Geology

The geological structure of coasts and the types of rock found there influence the erosion landscapes formed.

Soft rock— Easily eroded, cliffs will be less rugged and less steep. These landscapes include bays.

Hard rock—Resistant to erosion, cliffs are high and steep. These landscapes include wave-cut platforms, headlands, caves, arches and stacks.

Joins and faults—joints are small cracks in rock and faults are larger cracks in rocks. These both make rocks more susceptible to erosion. Rocks with more joints and faults are eroded quickly compared to rocks with few faults and joints.

Coastal flooding

Climate change— As atmospheric temperature rises, it is likely the intensity and frequency of storms will increase. This will increase the height of the waves and when combined with high tides and rainfall will increase the risk of flooding and erosion.

As sea temperatures increase the water expands and sea levels rise. Added to this ice melting on land adds to the amount of water in the oceans and seas, therefore increasing the risk of flooding.

Impact of UK climate on erosion:

Seasons—colder seasons lead to more mechanical weathering, stormier seasons lead to more erosion and warmer seasons lead to more deposition.

Storm frequency– areas susceptible to strong storms are likely to suffer with more erosion.

Prevailing winds—mainly from the south-west bringing warm moist air and frequent rainfall, this leads to more weathering and erosion.

Coastal human activity and management

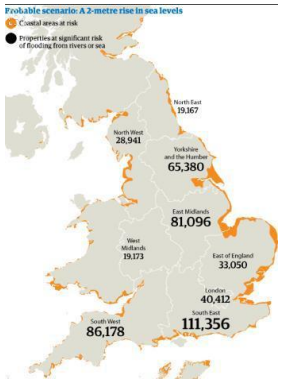
Human activities can have a positive or negative impact on coastal landscapes.

Development—the weight of buildings increases cliff collapse vulnerability, there is changes in drainage and increased cliff saturation leading to instability. However, it raises interests in protecting the areas.

Agriculture—increases soil erosion and sedimentation, although wildlife habitats can be created and preserved.

Industry– can cause air, soil and water pollution. It can destroy natural habitats for birds, animals and sea life. However, it improves the local economy.

Tourism—Increased development for hotels can increase erosion, increased pollution, increased revenue and desire to protect the environment.



Effects of flooding:

Erosion increases, depositional landforms destroyed, natural habitats damaged or destroyed, injury, death, psychological impacts, homes/settlements damaged or destroyed, loss of tourism, transport routes affected, loss of agriculture and lower economy.

Mass movement

Mass movement—the downhill movement of material under the influence of gravity. There are different types that depend on the material involved, how saturated the material is and the nature of movement. E.g.

Sliding - loosened rocks and soil suddenly tumble down the slope.

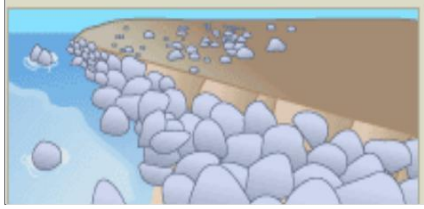
Slumping—happens when rock is saturated with water and slides down a curved slip plain.

Coastal management

Hard engineering—man made artificial structures that aim to protect.

Soft engineering—natural methods to protect the coast that work with the environment.

Rock armour or boulder barriers – large boulders are piled up on the beach and used to absorb the energy of waves and encourage the build up of beach material.



Advantages

Absorb the energy of waves.

Allows the build up of a beach.

Disadvantages

Can be expensive to obtain and transport the boulders.

Building a sea wall

Advantages

Protects the base of cliffs against erosion. Can prevent coastal flooding in some areas.
Land and buildings are protected from erosion.

Disadvantages

A sea wall is expensive to build. Curved sea walls reflect the energy of waves back to the sea. This means that the waves remain powerful. Over time the wall may begin to erode. The cost of maintenance is high.

Building groynes – a wooden barrier built at right angles to the beach.

Advantages

Prevents the movement of beach material along the coast through the process of longshore drift.

Allows the build up of a beach (a natural defence against erosion and an attraction for tourists).

Disadvantages

Can be seen as unattractive.

Can be costly to build and maintain.

Exam questions

1. Describe two effects of human activity on coastal landscapes (2)
2. Explain one way in which agriculture affects coastal landscapes (2)
3. Explain how climate change may affect coasts in the future (4)
4. Explain why climate change brings an increased risk of coastal flooding in the UK (4)
5. Explain conflicting views on one method of coastal management (4)
6. Outline one cost and one benefit of one hard engineering method of coastal management (4)

Beach replenishment/ renewal	Beaches absorb wave energy (energy is spent moving sand and shingle up, down and along beaches). A wide beach is the best defence against coastal erosion. Sand and shingle can be added artificially to beaches to protect the coastline against erosion and/or flooding. Beach replenishment also maintains beaches for tourism.
'Do nothing' and managed realignment	It is too costly to build and maintain hard structures to defend the UK's entire coastline. Moreover, the costs of coastal defence will increase in future due to climate change and rising sea levels. This means that maintaining the UK's hard coastal defences is unsustainable. Where the value of threatened property is relatively low, erosion may be allowed to continue. 'Do nothing' is a controversial policy. It allows natural processes, such as the movement of sand and shingle, to operate, and it is sustainable. But people may lose their property without compensation. Managed realignment allows some stretches of coastline to be flooded, either by letting the sea breach flood embankments or by dismantling sea defences.This has already happened in parts of Essex and Lincolnshire. A new, sustainable coastline is established further inland. Managed realignment may result in loss of farmland, but flooded land becomes new salt marsh and mudflat — important habitats for wildlife.

Do nothing approach – let the sea erode the land

Managed retreat – allow the land to erode however, they give compensation

Hold the line – put in management strategies

Advance the line – create new land, this is unusual as expensive

Integrated coastal management – there is a move in recent year to manage the coast as a whole (holistic management), as actions in one area can have an impact elsewhere. This is because of sediment cells – these cells form the basis for shoreline management plans (SMP).

Topic 4A: River Processes and Pressures

Three types of weathering

Mechanical weathering— freeze-thaw is most common in colder climates. When the water freezes in joints and faults it expands and causes the faults and joints to widen and eventually break away. Chemical weathering—this happens when the rocks mineral composition is changed. Granite contains feldspar which turns to clay when it reacts with water making it

easier to erode. Limestone is dissolved by carbonation as it is alkali and water is acidic.

Biological weathering—Caused by plants and animals, this helps speed up erosion. Trees roots can cause cracks and faults to be created and bird poo (guano) can dissolve minerals in rocks.

Three types of mass movement

Mass movement—the downhill movement of material under the influence of gravity. There are different types that depend on the material involved, how saturated the material is and the nature of movement. E.g.

Sliding/ creeping - loosened rocks and soil suddenly tumble down the slope.

Slumping—happens when rock is saturated with water and slides down a curved slip plain.

Erosion:

Hydraulic action—the force of the water on the bed/banks of the river.

Abrasion—the rivers bedload scrapes the banks and bed of the river.

Attrition—rocks and pebbles collide.

Solution—chemical action by water, dissolves minerals in rocks.

Factors affecting river processes—

Erosion rate—this is greater where the discharge is higher and energy is higher. The wetter the weather the more erosion takes place.

Transportation—Greater where water energy is greater which is when it is wetter.

Weathering—Greater in colder weather.

Amount of discharge—affected by climate, the wetter the weather/season the higher the river discharge.

Transportation:

Traction– large boulders are rolled along the river bed.

Saltation—smaller stones are bounced along the river bed.

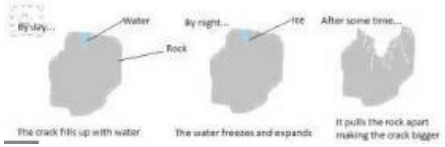
Suspension—sand and small particles are carried along in the flow.

Solution—some minerals are dissolved in water.

Deposition -When the river loses energy it may drop some of its load. This is called deposition

Exam questions:

1. Describe one change in gradient and one change in discharge along the course of a named UK river (3)
2. Describe one type of river erosion (2)
3. Describe one method of river transportation (2)
4. Explain how geology influences river landforms and sediment load (4)
5. Describe two slope processes that influence river landscapes (3)



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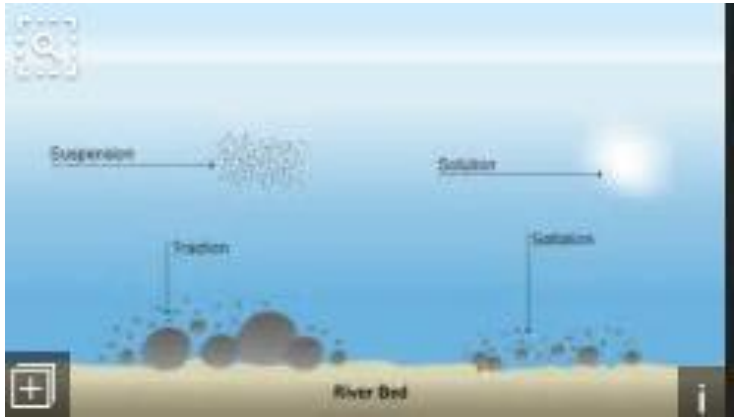


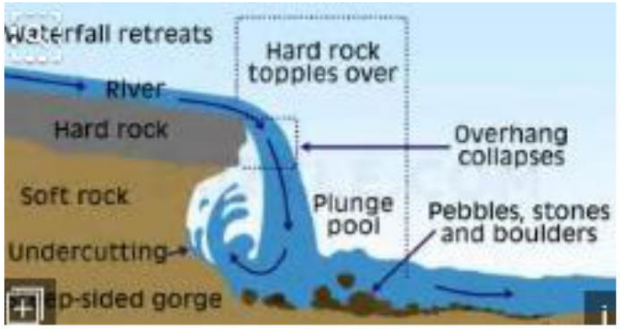
Upper course features Waterfalls—

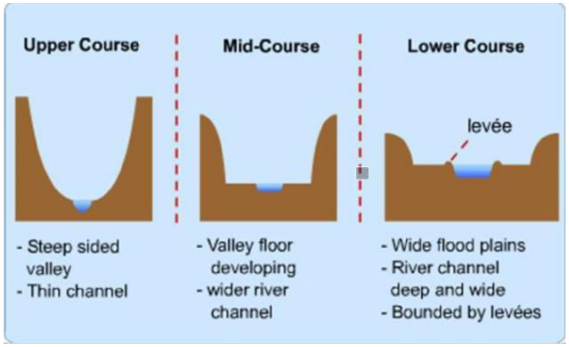
A band of more resistant rock lies over less resistant rocks. Less resistant rock erodes quicker leaving a step– the waterfall. More resistant rock is undercut, forming an overhang. The overhang can no longer be supported, blocks of rock fall down. Powerful fall of water erodes a plunge pool using fallen rocks. The waterfall retreats upstream leaving a steep sided gorge.

Interlocking spurs—

Vertical erosion is more dominant in the upper course leaving a steep sided valley. The river has limited energy and flows side to side, around ridges called spurs. The spurs become interlocking.

Characteristic	Upper course	Middle course	Lower course
Gradient	Steep	Less steep	Shallow gradient
Discharge	Small	Large	Very large
Depth	Shallow	Deep	Deep
Channel	Narrow, steep sides	Flat, steep sides	Flat floor, gently sliding slopes
Velocity	Quite fast	Fast	Very fast
Valley shape	Steep sides	Flat, steep sides	Flat, gently sloping sides
Features	Waterfalls, interlocking spurs	Meanders, floodplain	Meanders, ox-bow lakes, levees





Middle course features

Meanders—

these are bends in the river's course. Lateral is more dominant. The velocity of the river is higher along the outside bend; therefore, erosion is dominant. On the inside bend the velocity is lower and therefore deposition occurs.

Ox-bow lakes–

When the neck of a meander is eroded through, the river takes a straight course and deposition occurs blocking the bend. Thus forming an ox-bow lake.

Lower course features

Levees—

As the river floods over its banks, the water slows down. The water can't carry the biggest and heaviest silt particles and they are dropped straight away on the bank forming floodplains. Increased deposition on the river bed when the river is low gradually raises the river bed upwards. After many floods, the deposits on the bank build up forming, levees.

Deltas-

The speed of a river decreases as it approaches the sea and it deposits most of the material it has been carrying. Over time sediment builds up to create an almost flat area of new land, which is the delta.

Exam questions:

1. What two types of erosion are usually dominant in the formation of a waterfall plunge pool? (2)
2. Briefly describe how interlocking spurs form (2)
3. Explain how erosion and deposition form floodplains (4)
4. Briefly describe the main process affecting the lower course of a river (4)
5. Explain how levees are formed (3)

Physical factors affecting hydrographs:

Geology– more resistant rock absorbs less water and therefore encourages runoff.

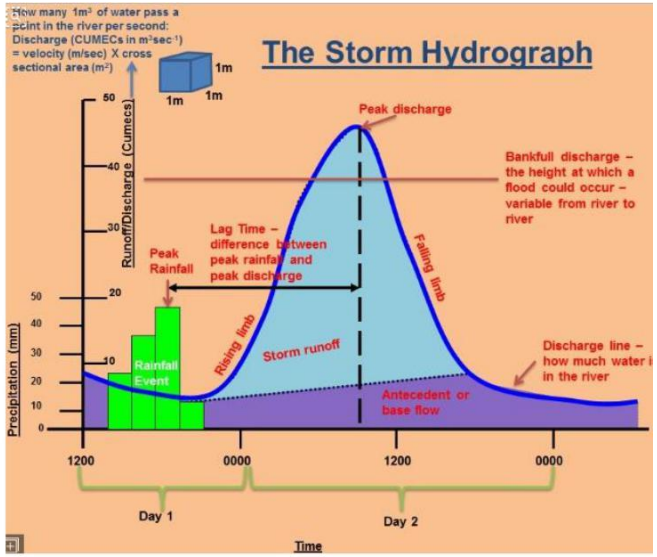
Soil type—more impermeable soils absorb less water and encourage runoff.

Vegetation– Plants encourage interception and this creates less runoff.

Slope– steeper slopes cause faster surface runoff.

Drainage basin shape– a wide basin with lots of tributaries close together encourages a steeper rising limb and short lag time.

Antecedent rainfall– when the ground is already saturated with water any extra water will create runoff.



Storm hydrographs and flooding:

Storm hydrographs are a way to show flooding on a graph.

- Lag time—the difference between peak rainfall and peak discharge.
- Bar graph—this shows rainfall in mm.
- Line graph—shows discharge in cumecs.
- Rising limb
- Falling limb

Human factors-

Urbanisation– Cities growing and creating impermeable surfaces.

Deforestation– Less vegetation leads to less interception and more runoff. Land-use change– fields that used to drain water and store water become impermeable and therefore runoff occurs.

Building on floodplains—Humans building on areas susceptible to flooding.

Types of river management

- Flood walls– require minimal maintenance, block the view of the river.
- Dams and reservoirs– scientists can regulate and control the water flow, expensive.
- Flood barriers—can be moved to where they are needed and are quickly erected, they don't provide protection for very long.
- Soft engineering methods– Use natural materials that work with the environment.
- River restoration– reduces flooding downstream, people living nearby may not want to change the landscape
- Washlands– Restricts economic development, allows the area to develop.
- Floodplain retention– provides somewhere for the floodwater to go, restricts economic development, attractive and provides space for leisure and recreation.
- Plant trees (afforestation)- increased infiltration, not suitable for all locations.

Increasing the flood risk-

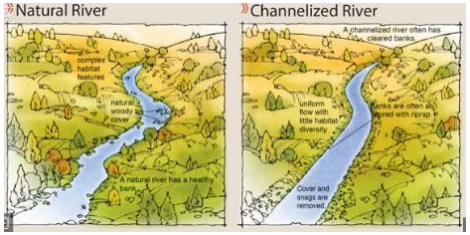
Climate change-increased frequency and intensity of storms, increased dry periods making the soils impermeable and increasing cold periods, which increases surface runoff.

Increased population – more people living by flood plains

Increased urbanisation – more construction of impermeable surfaces which increase surface run-off

Impacts of flooding-

Damage to homes, damage to agriculture, death and injury, disruption and damage to transport routes, damage to communication, damage to freshwater and electricity supplies, damage to wildlife, pollution and stress.



Afforestation	Trees are planted near to the river. This means greater interception of rainwater and lower river discharge. This is a relatively low cost option, which enhances the environmental quality of the drainage basin.
Managed flooding (also called ecological flooding)	The river is allowed to flood naturally in places, to prevent flooding in other areas - for example, near settlements.
Planning	Local authorities and the national government introduce policies to control urban development close to or on the floodplain. This reduces the chance of flooding and the risk of damage to property. There can be resistance to development restrictions in areas where there is a shortage of housing. Enforcing planning regulations and controls may be harder in LEDCs.

Dam construction	Dams are often built along the course of a river in order to control the amount of discharge. Water is held back by the dam and released in a controlled way. This controls flooding. Water is usually stored in a reservoir behind the dam. This water can then be used to generate hydroelectric power or for recreation purposes. Building a dam can be very expensive. Sediment is often trapped behind the wall of the dam, leading to erosion further downstream. Settlements and agricultural land may be lost when the river valley is flooded to form a reservoir.
River engineering	The river channel may be widened or deepened allowing it to carry more water. A river channel may be straightened so that water can travel faster along the course. The channel course of the river can also be altered, diverting floodwaters away from settlements. Altering the river channel may lead to a greater risk of flooding downstream, as the water is carried there faster.

Exam questions-

1. Explain how human activities can alter a storm hydrograph (4)
2. Explain how two physical factors affect storm hydrographs (4)
3. Explain how human and physical processes are causing river flooding on a named river (4)
4. Identify two threats of flooding to people (2)
5. Explain how land-use change can increase the risk of flooding (4)
6. Explain one cost and one benefit of a soft engineering approach to managing river flooding (4)
7. Explain one cost and one benefit of a hard engineering approach to managing river flooding (4)

Topic 5: The UK's Evolving Human Landscape

Why are population, economic activity & settlements key elements of the human landscape?
Differences between urban core & rural settlements & how UK/ EU policies have attempted to reduce inequalities

Comparison of UK urban and rural areas

	Urban core e.g. London	Rural periphery e.g. Cornwall
Population density	High & staying high Over 200 people per km²	Low 1 – 100 people per km²
Age structure	Many young adults Many single people	Many older people Some single people
Economic Activities	Retailing, large shops Offices & coporate headquarters Many jobs- shops, offices & factories Cultural centre – library, museum, theatre	Farming, fishing, forestry, mining Working from home – IT Tourism Renewable energies
Settlement	Metropolis, conurbation, city, large town Mix of high-&low-rise buildings Property more expensive	Market towns, villages & farms Low-rise buildings Property generally cheaper

Exam Questions

Define the meaning of enterprise zone (1)
Explain one way the government has tried to improve transport (1)
Explain how regional disparities have been reduced (1)
Explain two differences between rural and urban areas in the UK (4)

Key words

Multiplier effect
Population density
'northern powerhouse'
Conurbations
Core regions
Enterprise zones
Affluent
Grants

Reducing the gap between urban core & rural periphery

- Enterprise zones – places where the UK government offers companies help with start-up costs, reduced taxes on profits and access to superfast broadband. In 2015, there were 24 Enterprise Zones but they were all in urban England
- Regional Development Grants – available all over the UK & include grants & advice to help businesses start up. Most are targeted at rural peripheral areas but funds are small & investors have to raise 5.5 times the amount of any other government grant
- EU grants – help the poorest regions of the EU where the GDP is below 75% of the EU average. Only Cornwall, North & West Wales qualified in 2015.
- Improvements to transport – neither Cornwall, north Wales or Scottish Highlands have any motorways. Most transport investment is taking part in England's urban core e.g. HS2 railway linking London, Manchester, Birmingham & Leeds. Cuts in government budgets have reduced spending on transport elsewhere. However, Scottish government has invested in new Borders Railway between Edinburgh & Tweedbank.

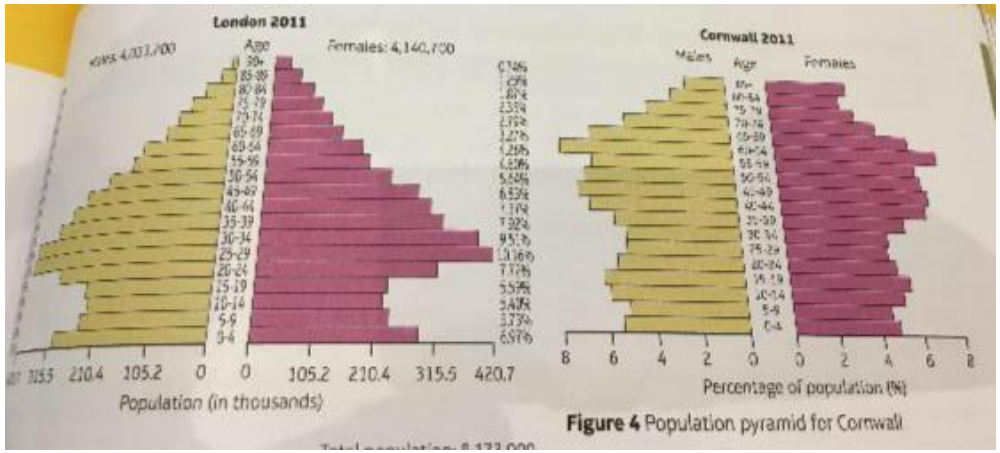


Figure 4 Population pyramid for Cornwall

How is the UK economy & society being shaped and linked increasingly by the wider world?

National & international migration over the past 50 years has altered the population geography of the UK, decline in primary & secondary economic sectors & increase in tertiary sectors in the urban & rural areas has altered economic & employment structure, globalisation & privatisation has increased FDI & TNC involvement

National migration

- Retirement migration – older people retire to a different part of the UK. SW England (Cornwall, Devon & Dorset) attracts many retirement migrants as it is perceived to have beautiful scenery, slower pace of life, lower crime rates & a sense of community. Adding large numbers of older people puts pressure on healthcare services & increases house prices. Higher house prices mean more young adults have to move away so there is a shortage of adults/ young children. However, older people create demand for services e.g. chiropodists, specialist shops & social activities which create jobs
- Rural to urban migration - farming can be difficult due to steep slopes, high mountains & thin soils. Apart from fishing or quarrying in isolated rural areas, there are fewer job opportunities so young people move to find better jobs in cities, which leaves a large concentration of older people
- Counter-urbanisation – when people move away from cities to the rural areas e.g. 68 000 more people left London in 2014 than moved there.

International migration

- In 1950s, UK government encourage immigration from former colonies e.g. Caribbean, India, Pakistan & Bangladesh to fill jobs in transport & textiles/ steel industries. By 1971, 1 million people have moved to the UK; mostly young adults with children or single men
- In 1970s, immigration came under government control as there were no longer shortages in workers so the numbers reduced. Many immigrants went to Bradford, London & Birmingham to find the jobs
- When the EU expanded around 2004, immigrants from Poland, Latvia & Estonia began to arrive. 80% of these immigrants were 18-24. They when to cities such as London & Birmingham for jobs in industries/ services or to rural areas for farming jobs. In 2014, 560 000 people immigrated to the UK & 317 000 emigrated from the UK.
- In 2012-15, many people fleeing from war in Syria & Afghanistan migrated to the UK

Impacts of international migration

- Provide a source of cheap & unskilled labour as well as skilled labour
- Migration to cities increases population density & puts pressure on services e.g. schools
- Reduces the impact of the UK's ageing population
- Introduce their home culture to increase multiculturalism

Decline in the North East

- Economy of the NE used to be dominated by heavy industry e.g. coal mining/ shipbuilding. In the last 50years this has declined due to foreign competition, high land & labour costs & end of coal deposits.
- In 1971, manufacturing was 40% of employment but in 2011, this was only 10%. Between 2007 – 2013, unemployment rose quickly to 8%. The contribution of the area to national GDP is only 2%. Between 2011-12, child poverty rates in Middlesbrough & Newcastle rose 39% on average
- In rural areas, economy still relies heavily on agriculture. Mining, fishing & quarrying are very small scale. Manufacturing is based in urban areas but employs fewer people due to increase in machines & new technology. Tertiary activities have increased which has reduced unemployment slightly.

Rise in the South East

- Most prosperous farms are found in the SE e.g. fruit, wheat & barley farming.
- Manufacturing industry is growing rapidly in urban areas e.g. oil refineries in Southampton and the M$ corridor where electronics & engineering companies are located
- SE region is also important for tertiary & quaternary industries where there is a range of financial & business service firm located in the region. Unemployment is at a low (6%) and prosperity is high. New tertiary & quaternary firms are locating in town which are surrounded by green spaces
- Transport – range of motorways, 4 major airports, ports for import/ export
- Markets & labour – 19 million people for goods & services
- Political – national government & corporate headquarters of many firms

Globalisation

Manufacturing, tertiary & quaternary industries are being increasingly affected by decisions & events in other parts of the world

- Networks – linking countries together e.g. internet/ trading blocs
- Flows – goods & services that move through networks e.g. raw materials, goods, money & workers
- Global players – organisations that have a big impact on the

Free trade

Firms need to take part in international trade to increase their profits. Global links can significantly increase the market for a firm. Not all trade is free trade which is trade without tariffs or import duties. Some countries have high import duties to protect their industries. The UK, as part of the EU, has pursued a policy of promoting free trade with the EU to allow the free movement of goods & services which should make them cheaper.

Transnational Companies (TNCs)

TNCs are large companies that operate in a range of other countries. They are powerful players in the global economy and link up national economies in many different parts of the world. The top TNCs are involved in 3 main industries – oil, electronics & motor vehicles. Some TNCs are specialised e.g. Nestle (food & drinks) or Rio Tinto (mining) where are others e.g. Mitsubishi have a range of interests e.g. vehicles, air transport & food processing

Exam questions

State two characteristics of quaternary sector employment (2)
Explain the trends in primary & secondary employment in the UK since 1980 (4)

Explain the reasons for the increase in the UK's population (4)
Explain the impacts of globalisation on the UK economy (4) Compare the main differences in economic & employment structures in two contrasting regions of the UK (3)

Privatisation

Privatisation of many industries e.g. steel, railways, computers, airports, docks, petroleum, electricity, water, gas & postal services
Effects include:

- Increased Foreign Direct Investment from businesses wanting to invest in the UK
- Increased awareness of global markets & increased competition
- Increased foreign ownership of UK firms
- Dividends & profits from some UK based firms going abroad

Key words

Globalisation
TNCs
FDI
Networks
Flows
Global players
Privatisation
Capital
Infrastructure

Foreign Direct Investment (FDI)

FDI is composed of the flows of money (capital) from businesses in one country to another. The flow of finance allows the companies to become involved inn the business life & markets of the receiving country – for the UK, this is the EU markets. The companies can vary from giant TNCs e.g. GlaxoSmithKline. In 2014, the largest investor in the UK was the USA. 50% of investment into the UK came from European countries. Most of the investment was in energy projects e.g. wind & nuclear or infrastructure e.g. airports & hotels.

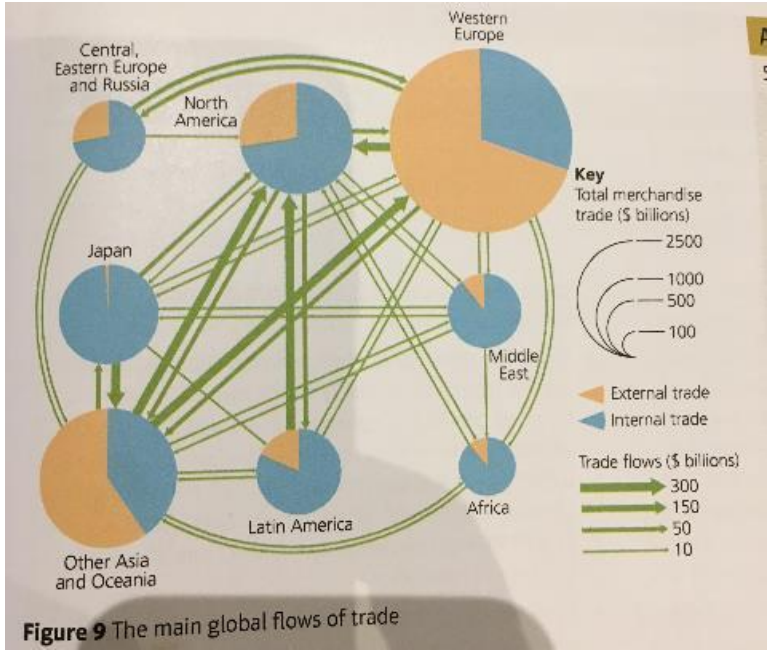


Figure 9 The main global flows of trade

Context of the city influences its functions & structure

Significance of site, situation & connectivity of a city in a national, regional & global context. City's structure in terms of functions, variations in land use, building age & density & environmental quality

Site of London

Being close to Europe meant that London could trade there by sea quickly. Even when large industrial cities in the North/ Midlands were growing during the Industrial Revolution, London had a bigger population, economy & port. Internationally, London's time zone helps its economic growth today. Those working in finance can trade with Asia, Australia & New York in the same day.

Site of London

Romans bridged the Thames after their arrival in Britain in 43AD. The site they chose was the last place the Thames was shallow enough to cross. Market traders originally met there but the new bridge met. With the market came houses and within decades a significant town – 'Londinium' had grown. By 200AD Londinium had become the capital By 1300, further growth brought traders by sea, land & in search of work.

London – world city?

- Internationally – London has the world's 2nd biggest airport, Heathrow. If you added all the international passengers from all 4 airports then London is the world's largest international air hub. Eurostar also brings major European cities within a few hours travel.
- Nationally – UK's fastest rail service links London & major UK cities with fast travel times. However, while urban core regions have become closer to London, rural peripheral areas seem further away.
- Regionally – most major A roads & motorways lead to London which links it to other major cities.

London's cultural diversity

Middle ages brought Protestants seeking religious freedom & Kews escaping persecution. London's knowledge economy makes it a global magnet for migrants.

London's structure

London, like many other cities, has a structure to its layout. The high-rise buildings are clustered together with green space on the outskirts of the city.

Key words

Site
Situation
Connectivity
Internationally
Nationally
Regional
Central Business District

Central Business District (CBD)

The CBD is the oldest part of the city & is where most of the offices are found. London's radial roads mean that its very accessible from all parts of London. This leads to higher land prices which make it densely built up. Therefore buildings are built high to maximise value. London's CBD has expanded recently to include Oxford Street in West London & Canary Wharf in East London. Central London benefits from large parks e.g. Hyde Park but also has the UK's worst air quality due to traffic.

Inner suburbs

In the Industrial Revolution, factories & densely packed terraced housing were built close to central London. A few high-income suburbs also developed whose population (rich upper-class) wanted to be close to the city. The inner suburbs are very varied – Kensington is one of the world's most expensive suburbs. Hackney is an area of old factories & new flats. Large houses are now being divided into flats for rent. The environmental quality varies between run-down areas (Hackney) & Kensington.

London's urban-rural fringe

Where the city meets the countryside is the urban-rural fringe. Almost every house has a garden, so building density is lower. Most houses were built in the late 20th century& there is some industry, near underground, but the area is mainly residential. Environmental quality is much higher.

Exam questions

Explain why some cities are better connected than others (4)
State two characteristics of the inner suburbs (2)

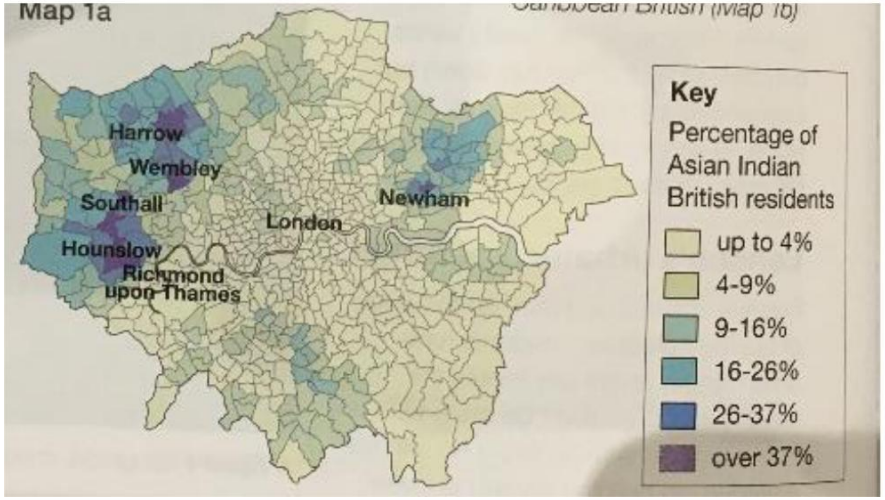
London & migration

Most migrants are adults aged between 18-35. Internal migrants from within the UK tend to be recent graduates from UK universities seeking work & a London lifestyle. International migration consists of skilled & unskilled workers.

Skilled workers – take up well-paid jobs in the knowledge economy in London. Migrants with particular skills get jobs when there are not enough skilled people in the UK. Most migrants tend to be white, high-qualified professionals from the EU, USA, South Africa & Australia.

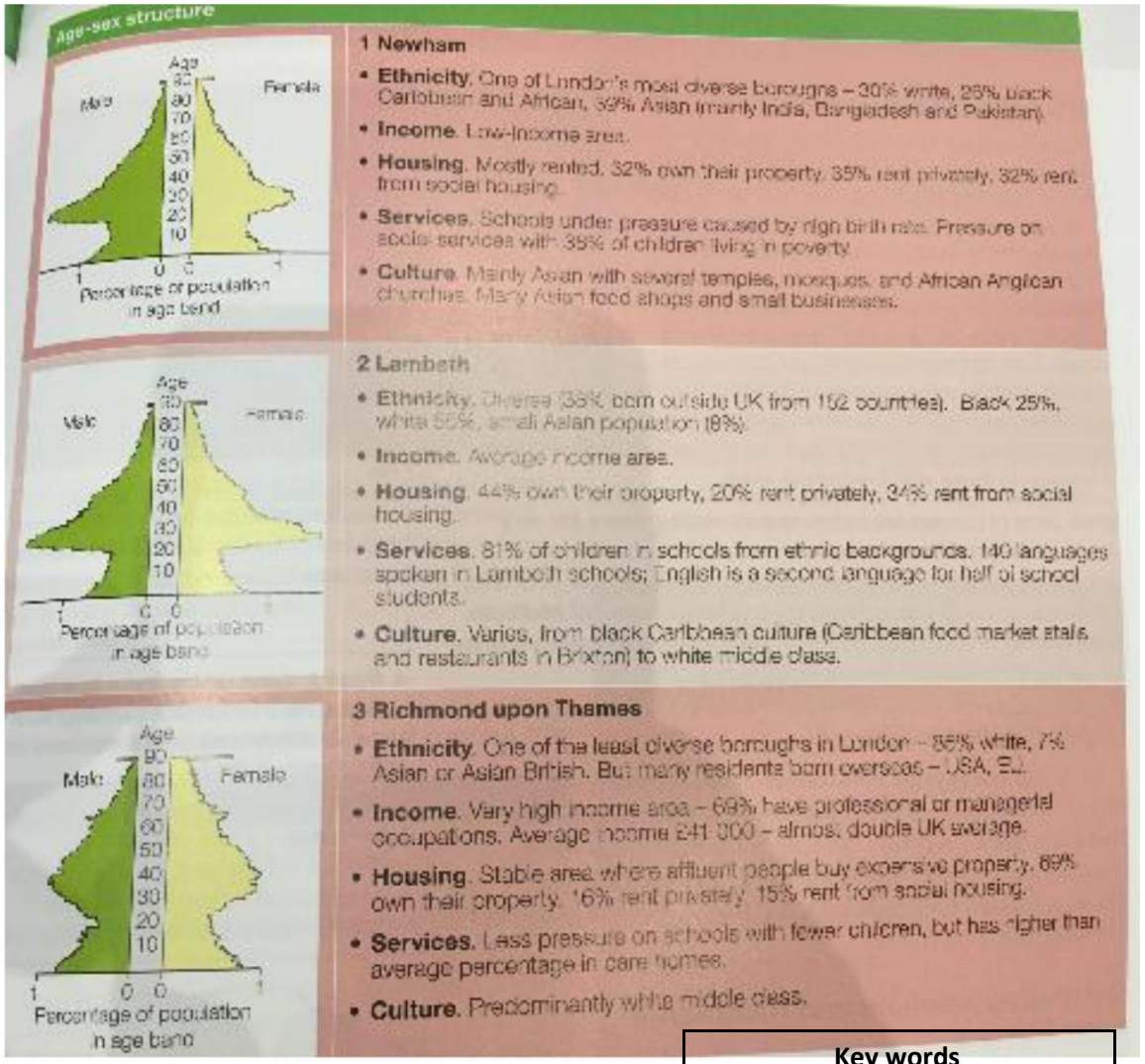
Unskilled workers – do jobs unwanted by UK workers (refuse collection), unsociable hours (pizza delivery). Construction, hotel and restaurant companies would not have enough workers without them. any come from the EU, but also India, Pakistan, Bangladesh & West Africa.

Most recent migrants seek cheap rented accommodation. They aren't eligible for social housing so take private rented property in inner city areas. Clusters of particular ethnic communities develop which help defend migrants from discrimination, support ethnic shops & services & help to preserve cultural distinctiveness



The city changed through employment, services & movement of people

Causes of national & international migration that influence growth & character of different parts of the city. Reasons for different levels of inequality, employment, services, health & education.



Exam questions

Assess the impacts of the variations in ethnic group distribution shown (8)

Key words

Skilled
Unskilled
Internal migration
Overseas immigration

London's inequalities

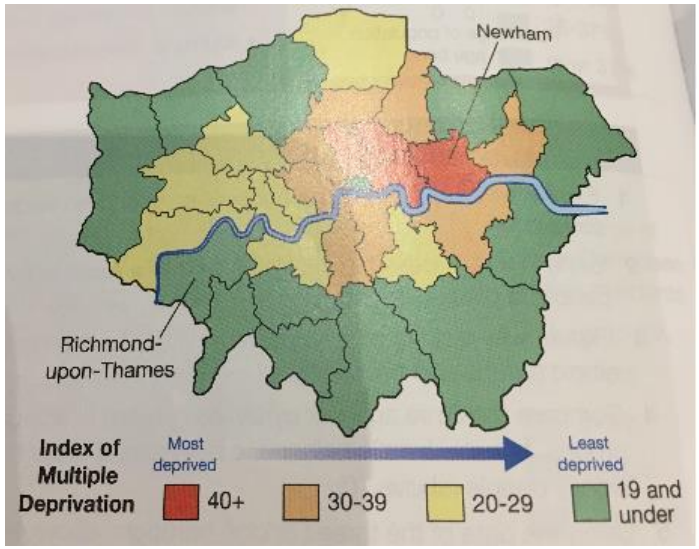
Deprivation has several causes. The government collects information on employment, health, education, housing and services to produce an Index of Multiple Deprivation, which shows how deprived places are. In 2012, over 2 million people lived in poverty (28% of the population). Incomes in London are more unequal than any other part of the UK.

Key words

Deprivation
Index of Multiple Deprivation

Comparison between Newham & Richmond upon-Thames

	Newham	Richmond
General health		
Infant mortality (per 100)	5.5	2.75
People with long-term illness	12.3	7.6
Premature deaths (before 65/100 000)	210	121
Education		
% with 5 GCSEs A*-C	38	37
% of 19year olds without education	41	37
% 5-16year old on FSM	20	8.4
% adults with degree	26	64



Comparison between Newham & Richmond upon-Thames

Newham is one of London's most deprived boroughs while Richmond is one of the wealthiest. Incomes were low in Newham, so more students are on free school meals

Incomes in Richmond are twice as much on average than Newham. The percentage of those with degree qualifications is much higher which allows people to get better paid employment Health of those in Newham is worse, with more people having a limiting long-term illness which limits people's ability to learn & work. In both areas, percentage of 19year olds without qualifications is high, meaning they are limited to unskilled jobs.

Indicator of deprivation	What it measures	Proportion of population living in areas of London with this indicator
Income	People on low incomes	High
Employment	Those unable to work through unemployment, sickness or disability	High
Health and disability	People in poor physical or mental health	High
Education, skills and training	People with low educational attainment	Low
Housing and services	Affordability of housing and within reach of services, e.g. transport, doctor	Housing – Very high Services – Low
Crime	People affected by crime	High
Living environment	Those living in sub-standard housing (e.g. lack of heating, damp)	High

Exam questions

Assess the causes of differences in life expectancy (8)

The changing city creates challenges and opportunities

How parts of the city have experienced decline, de-centralisation, e-commerce, developments in transport, economic and population growth

Deindustrialisation & depopulation

- Deindustrialisation - London's dock closed in 1981, due to the use of containers to transport goods by sea. The new container ships were larger so ports moved downstream where the water was deeper. Industries that relied on the port moved too. Industries in London's biggest manufacturing area closed down. In 2001, only 7.5% people worked in manufacturing, from 30% in 1971
- Depopulation closures had a massive impact on communities. East London had an unemployment rate of 60% in some areas. People left in search of work – over 16% of the population left inner London suburbs between 1971-1981 (500 000 people!)

Decentralisation

Shift to the suburbs meant people spent their money there. People began to shop by car, not train & this shifted the shopping activity & employment from the CBD towards:

- Out of town shopping centres – developed undercover shopping to attract customers e.g. Treaty Centre, Hounslow
- Retail parks – built away from suburban shopping centres but close to major circular roads
- Business parks – areas for employment e.g. Stockley Park near Heathrow
- E-commerce – buying online has further decreased the shopping e.g. Amazon

Response

Spending money outside London means the city doesn't gain the income. Australian company Westfield has developed two shopping centres in inner London

- Stratford, East London
- Shepherd's Bush, W London

Suburbanisation

Suburbanisation – depopulation speeded up a process whereby outer London suburb gained people that left inner London suburbs. Flats were replaced by houses with a garden. Over 1.5 million left London between 1951 – 1981. Reasons for suburbanisation include:

- Underground was established by 1930 so workers could be in the inner city in 30 minutes
- Electrification of surface rail made it easier to travel to London from further away e.g. Guildford which is 50km away

Growth of London

London is 70km North – South & West- East. Reasons for London's growth:

- Counter-urbanisation – people have moved to the surrounding counties which has blurred the boundary between city & countryside
- Suburbanisation – same amount of people take up more space – small flat to house with garden
- Family size – fertility rates were 3 in 1961 which means they are having their own families
- Increasing divorce/ later marriage – more single occupancy homes need to be built

Re-urbanisation

Since 1991, more people have returned to London causing London to regrow due to:

- Space – closure of London's docks & industries created space for redevelopment. New housing & buildings were developed on brownfield sites
- Investment – large TNCs have created jobs in financial & business sectors
- Gentrification – high-income earners prefer to live closer to work so improve the area to include theatres, bars & restaurants
- Studentification – student spending generates need for goods & services

Key words

Suburbanisation
Depopulation
Electrification
Deindustrialisation
regeneration
Brownfield sites
Re-urbanisation

Green belt

To limit London's growth, a green belt has been introduced by planners to protect the countryside. No major building is allowed in this area, but it can continue beyond it.

Culture & leisure

London's 2012 Olympic Games left a huge park – Queen Elizabeth Olympic Park. Before the 2012 Games, it was a derelict area. In 2016, the Olympic Stadium has become West Ham's new football station. Athletic & music events are also held there. Meanwhile, a new cultural area is being opened by Sadlers Wells Opera Company

Exam questions

Assess the reasons for re-urbanisation that are taking place in London (8)

Explain why many UK cities are experiencing growth in outer suburbs, not inner cities (4)

Ways of life in the city can be improved by different strategies

How regeneration and rebranding of the city has positive and negative impacts on people and strategies can make urban living more sustainable and improve quality of life in the city

Changing environmental quality

Areas which were once run-down have become more desirable due to gentrification.

Environmental quality has also improved due to regeneration e.g. Olympic Park. Inner-city London has many established parks e.g. Victoria Park in Hackney. But many areas still have little open space nearby. Pressure on housing means that space is being used for housing, not parks so the population density of London is increasing.

Economic opportunities

In 2015, London's GDP was as large as Sweden's! Advantages include:

- Growing economy creates jobs which attract people – 35 000 new jobs will be created each year until 2036 & range from low wage to high salary employment
- London's construction industry is rapidly growing due to demand for housing & offices Disadvantages:
- Expensive to live here – housing demand drives up house prices
- Companies pay people more to work in London so price of meals/ drinks is higher
- Average lifestyle for London requires around £39 000 a year!!

East London's rising population

Between 1951-81, the population in East London declined but that has been reversed to become a rapidly growing population of young professionals. Tower Hamlets, an East London borough, has grown by 58% since 1981. Many inner-city suburbs have been rebranded e.g. have had a change of image. The impacts include:

- Land that has been derelict is now housing, offices & hotels
- New transport links e.g. DLR, bus routes & tube links
- London's housing is increasingly becoming expensive
- Population growth is faster than the rate of houses being built
- Overseas investors buy London property but do not live in it

Commuting

Every day 3 million people in London travel to work. 90% of the UK's travel by tram & underground & 75% of all train travel happens in London. Travelling to work affects people's quality of life. If London was to be more sustainable, quality of life could be improved. This involves:

Transport	Affordable Housing
Green Space	Energy efficiency
Waste	Employment

Making London more sustainable

	Aim	Outcome
Transport	Reduce greenhouse gas emissions	Congestion charge introduced in 2003 to encourage more people to use public transport All London buses are hybrid which reduces CO2 emissions 4500 electric vehicle charging points to be in place by 2018
Employment	People encouraged to work from home ½ days a week	Number of people who work from work increased from 4.3% to 8.6% in 2012 Increase in flexible working hours which helps people avoid rush hour/ pay cheaper fares
Affordable housing	To increase the amount of affordable housing	East Village in Stratford has 50% affordable housing but still need to earn £60 000! Shared ownership is becoming more common – own part of a property & rent the rest
Energy efficiency	To promote sustainability	BedZED has 100 apartments & offices – it uses 81% less energy for heating, 45% less electricity, recycles 60% of waste & 58% less water. It is London's only project though.
Green Spaces	Increases quality of life	Can lead to loss of farmland & loss of rural scenery. The Green Belt around London could be in trouble – it is close to London & ideal to build houses
Waste	Reduce household waste by 10% by 2010	Re-using waste & providing accessible recycling/ composting services (bins everywhere) Developing waste-burning power stations to create heat & power

Exam questions

Evaluate the success of strategies aimed to make urban living more sustainable (8)

Assess the impacts of the cost of living on different groups of people (8)

Key words

Rebranded
Commuting
Quality of Life
Sustainable

The city is interdependent with rural areas, leading to changes in rural areas

The city and accessible rural areas are interdependent so rural areas experienced economic and social changes due to its links with the city.

Terling – a rural area

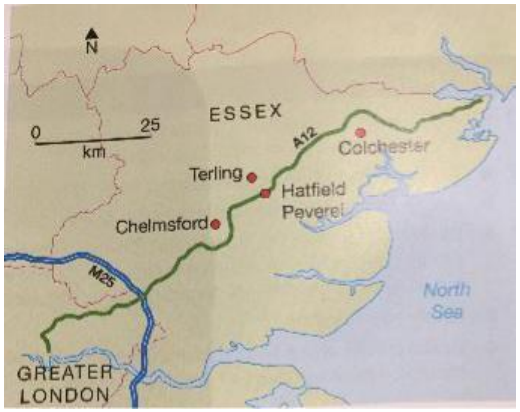
Terling is an English village, near Chelmsford in Essex. Services in Terling as struggling. The village shop fights for survival, the doctors surgery is only open 5 hours a week, the bus only runs twice a week & the pub has closed. Dairy farms no longer provide jobs as the cost of milk has decreased but there has been an increase in grain prices. However, outside contractors are brought in to farm grain. Despite these problems, property prices in Terling are high & the village primary school is full. This is because:

- Trains only take 45minutes to London
- The A12 is nearby, linking it to London & Colchester
- Chelmsford is only 7 miles away so people go there for supermarkets, shops & services

Terling relies on London & Chelmsford for goods, services & work

Interdependent relationship

Chelmsford's population has increased from 58 000 in 1971 to 168 000 in 2011. It's population growth is due to people migrating from London. This works well for people as high London salaries mean that rail tickets are affordable & house prices are much cheaper. London relies on the rural-urban fringe as there are not enough people living in London to work. Rural-urban fringe areas benefit from higher salaries paid in London but residents have to deal with crowded commuter trains & congested roads. Housing estates are built on the edges of London, so the fringes shift outwards so Greater London changes from outer suburbs, to green belt to dormitory town to villages to rural landscape.



Biggest IT move in history In 2003, the Metrological Office (responsible for the weather) moved 1200 people from its' office in London to the Exeter in East Devon. It meant new jobs for the rural region as not all staff moved. The local council estimates that the move has brought an extra £74million annually to East Devon through the multiplier effect. This is due to:

- Money spent moving house e.g. grants towards moving costs
- Regular weekly spending e.g. shopping, leisure, supermarkets

Why choose East Devon?

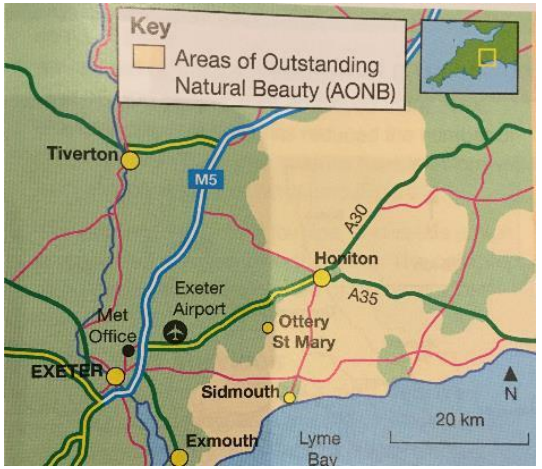
- Land rental is much cheaper £9 per sq ft (£90 per sq ft in London)
- Daily flights from Exeter Airport to London, UK & Europe
- Good train links & road links (M5)

Problems created by the move:

- Population change – in 2015, 5000 migrants moved there from other parts of the UK. It is also sunny & accessible. Part of the increase is due to retirement migration & some is family migrants
- Pressure on housing – 2/3 of Devon is classes as an area of natural beauty (AONB) which makes planning permission hard to get which pushes up house prices. Average incomes are 10% below natural average but housing is only 3% cheaper here so more affordable housing is needed
- Pressure on leisure & recreation – many attractions are located close by – Jurassic Coastline (Swanage!) & Dartmoor national park. 15 million-day trips are made every year. This puts pressure on the roads and

Rural-urban fringe

The bigger area surrounding London is called the rural urban fringe which lies beyond the suburbs & is mainly rural but depends on London for work & services. 650 000 commuters leave place like Terling to work in London. These settlements then come dormitory towns & villages – places where people sleep but are away during the day.



The changing rural area creates challenges and opportunities

The challenges of availability and affordability of housing, decline in primary employment, provision of healthcare and education and how they affect quality of life (IMD) for some rural groups New income and economic opportunities are created by rural diversification and tourism projects may have environmental impacts.

Cornwall

540 000 people live in Cornwall with 4 million tourists visiting it each year. It has a 700km coastline with sandy beaches. It has one of the UK's fastest growing populations.

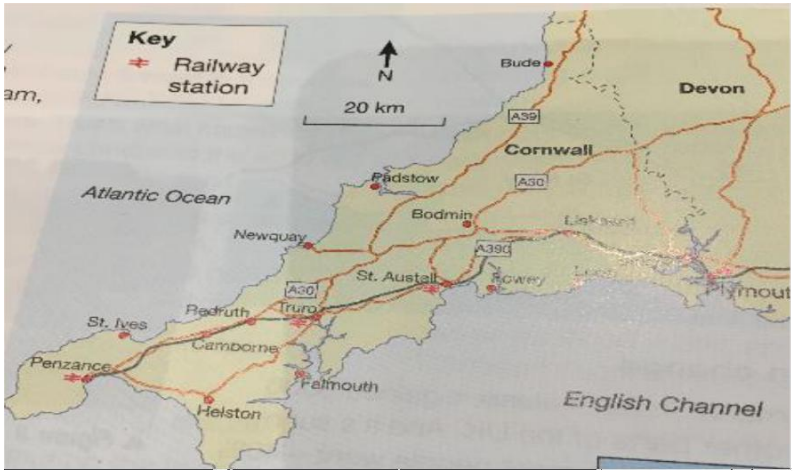
Health & services in Cornwall

West Cornwall is one of the UK's most deprived areas. It has a high percentage of elderly people, few services & lowest average wage.

- Only 38% of villages have a doctor's surgery & most are only open once a week. 70% of villages have buses but they only run 3-4 times a day
- Main hospital in Truro but for many people it is over 30 miles away – difference between life & death
- Young people have to travel 30 miles for 6th form education/ training & travel costs are high

Issues in Cornwall

- Length of county – 140km from one end to another. Transport is very slow – no motorway & trains take 2 hours.
- No large population centres – largest only has 23 000 people
- No knowledge economy to raise incomes so Cornwall has the UK's lowest weekly wage (£340 compared to £660 in London)
- Much employment is seasonal, part-time & low wage



Primary industry in Cornwall

Decline of primary economy had left the county with few permanent, full-time jobs

- Farming – number of cattle farms has fallen by 60% since 2000 due to falling milk prices
- Fishing – stocks in decline due to overfishing by UK/ EU fishing boats
- China clay quarrying – one employed 10 000 people in 1960s but TNCs have moved overseas for cheaper clay
- Tin mining – collapse of tin prices has meant closure of Cornwall's last tin mine in 1998

Index of Multiple Deprivation in Cornwall

- Income – Low
- Employment – medium
- Health & disability – low
- Education, skills & training – low
- Housing & services – very high
- Crime – very low
- Living environment – very high

The Eden Project

It opened in 2001 as a year-round tourist attraction. It provides people with full time employment. From 2001 – 2010:

- 13 million people visited
- Visitor spending (hotels/ food) made an extra £1 billion
- It employed 700 people & created 3000 other jobs
- 97% of visitors arrive by car affecting the environment
- Visitor numbers are falling

Farming & diversification

With farm incomes falling, farmers make an income in alternative ways. This is called diversification whereby they do a wider range of activities to enable a farm to survive

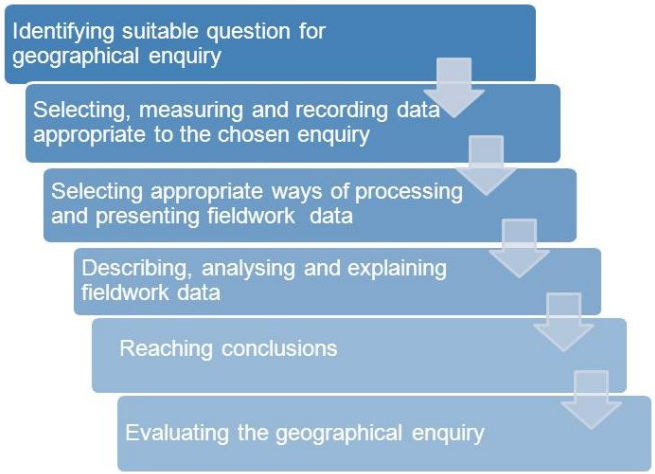
- Farm shops – 3 families developed a farm shop using a £200 000 grant from the UK/EU government. Shops sell meat & vegetables which has created 12 full-time jobs & 8 part-time jobs. They have gone from £30 000 income per year to £700 000 per year. Every £10 spent in farm shops becomes worth £23 in the local economy through the multiplier effect.
- Tourist accommodation – barn conversions & camp sites can give farms additional money. A few farms have also invested in log cabins, health spas & swimming pools. While this has increased tourism, it has led to a reduction in nesting places for birds such as swallows &

Fieldwork revision - Coasts

In this section of the exam you are required to discuss our coursework for both Urban (London) and Coastal (Eastbourne) results in detail along with applying your knowledge of the process of undertaking coursework to other situations and sample data sets collected by other people.

Fieldwork process

The aim of your coastal fieldwork was to measure the impact of coastal management (hard or soft) on both processes (erosion, transportation and Long shore drift) and communities (house prices, jobs, tourism).



We hypothesised that:

Hard engineering would have a positive impact on the local communities by reducing erosion and flood risk

Soft engineering such as do nothing would have a positive impact on the wider community by promoting longshore drift but would leave some area more vulnerable. Overall this would have the least impact on natural processes.

Sub-question- these help focus the investigation and can be answered in the analysis.

- **Beach width and sediment**- groynes will produce a wide beach by stopping transportation by longshore drift.
- **House value and jobs**- groynes and sea walls will promote tourism and create jobs. Hard engineering will increase the house prices in an area as people feel less at risk from erosion and flooding.
- **Wave Count and Long Shore drift measurements.** Higher waves counts will mean more erosion and destructive waves and faster rates of LSD will mean more erosion as the beach will be narrow.

Location and sites
The sites chosen to investigate these were Birling Gap and Eastbourne, both on the south east coast.

Birling Gap, - managed retreat
Chalk cliffs and wave cut platform, concordant coastline, prevailing wind is from the south west leaving the cliffs exposed to destructive waves
small village and one museum on coastal erosion.

Eastbourne- sea wall, groynes and beach replenishment

Variable	Method	Justification	Control	Evaluation
Longshore drift *Primary*	Measure our ten meter distance along the sea front Drop a float into the swash before the start point Record how long it takes for the float to travel ten minutes	This helped us to understand if the groynes were useful and cost effective as the more long shore drift as occurring the more use the groynes are	We complete the measurement three times to collect at average which reduces the impact of strong gust of wind. We dropped the float before the start point	The strong wind and tide made this difficult to complete. The oranges were a bit heavy but were still blown by the wind.
Wave Count *Primary*	Using a stop watch record all the breaking waves in 1 minute.	The greater the number of waves the more erosion in an area.	We completed this three times in each location with one person watching the stop watch and one person counting the waves.	The gust of winds made this difficult but overall it was reliable data and we reduced the human error by completing it three times.
Sediment Analysis and Beach Width *Primary*	At 10 meter intervals moving away from the beach record the long axis length of three pebbles and they shape code.	This allowed us to see how much erosion had occurred at different areas up the beach and how wide the beach was. A wider beach is more effective at stopping erosion.	We used random sampling the select three pebbles in each location.	The width of the beach will change with the times of day which mean our data is less reliable however the pebble size did show larger pebbles at the back of the beach.
Questionnaire *Primary*	Ask three different people their views on the Coastal defenses and reason for being in Eastbourne.	This allowed us to collect qualitative data on people's views	We used opportunity sampling as there were only a few people available to talk to	The small sample size means the results are less reliable and could be bias.
RightMove *Secondary*	Research the sale price of the three most recent 3 bed houses to sell in each location.	This allowed us to see the impact on people and house prices	By using three houses with the same number of bedrooms we tried to keep the comparison fair.	The houses all sold at different times and as Eastbourne had more houses there was more recent sale prices.
Tourist England *Secondary*	Research the statistics on touristy numbers and value in Eastbourne website	See the benefits of tourism linked to the wide beach made by groynes	This is collected for the government so should be professionally collected.	As we didn't collect the data we cannot be sure if it just covered Eastbourne or includes the local villages and beaches such as Birling Gap as well

Data presentation. This section is to simplify the result and findings. There are two main types of data

- Quantitative→ Data collected as number. This can be easily compared and plotted on graphs but can over-simply complex ideas
- Qualitative→Data collected as words and description. This is great if we want to understand opinions and feelings. It can be used as quotes or coded to turn it into more quantitative data.

1. We used bar graphs for our Wave Count, house prices and Longshore Drift results
2. We used Pie charts for out questionnaire answers
3. We used scatter graphs for our beach width and sediment size comparison.

Data analysis

This section is to explain the findings from our primary and secondary data and answer our hypothesis.

Our primary data showed a much wider beach at Eastbourne showing the groynes were very effective. This was reliable data and matched our hypothesis. However we should have visited at high tide and low tide to be more confident. The late sediment at the back of the beach in Eastbourne showed the waves very large stones at the back of the beach meaning this area experienced little erosion.

Our primary data showed higher wave counts and more longshore drift in Eastbourne. This was not what we expected. The prevailing winded from research were from the south east but unusually weather (the kind which brought all the snow) meant winds were coming from the north east. The strong gusts of wind heavily impacted on our wave counts and long shore drift processes. Research and theory showed these were unusually conditions and that normally Birling gap was more exposed.

Research and secondary data showed higher house prices in Eastbourne and tourist England information showed that over 4million was spent by tourists in the town each year. Whilst this is reliable data as much of it is professionally collected as we did not collect the data it is less specific. We can be less confident in the house price data as we did not visit the houses to consider their size or condition which could bias the results. However it does match our hypothesis.

Our primary questionnaire data supported these findings with most of the people questioned at Eastbourne being for holidays or just visiting however this is less reliable as we used opportunity sample and mainly those with spare time were able to talk. Conducting this at lunch time on a week day also impacted the results. In Birling gap there were not enough people to conduct questionnaires.

Conclusion and evaluation.

In conclusion our investigation was successful as we were able to measure the impact of coastal management on processes and people and found that generally hard engineering was more positive and beneficial. However we were less able to to understand the wide impact of doing nothing at Birling gap as the benefits were likely to have been experienced further down the coast as the sediment was being transported.

When evaluating we must consider three key ideas:

Validity- how accurate was the equipment or research we used.

- E.g. the oranges were not very good floats and were effected by gusts of wind.

Reliability- how likely our we to find the same results if we conducted the same methods again.

- E.g. the small sample size and times of Day gave specific answers

Human error- did we record the data properly and in the right places

- E.g. did you randomly select the pebbles and measure 5m intervals or did you estimate which could bias the results.

Q and A

Assess the impact of coastal management on the people and processes in Birling Gap and Eastbourne (8)

- ❑ I have stated the coastal management strategy used in Birling Gap and given the reasons it has been chosen.

- ❑ I have explained that there is no action to reduce erosion or transportation and that the cliff is quickly eroded due to prevailing winds from the South West.
- ❑ I have explained that this has a big impact of the communities and most have had to leave the area
- ❑ I have assessed that the impact is now small as not many people live their anymore and the cliffs produced by the erosion are an important tourist attraction so arguably managed retreat has a positive on the wider local community- e.g. people can walk their from Brighton or Eastbourne and visit museum.
- ❑ I have stated Eastbourne uses a combination of hard (groynes and sea walls) and soft (beach replenishment) strategies.
- ❑ I have explained that these have a big impact of processes by stopping erosion and transportation and increasing deposition.
- ❑ I have explained this has a big positive on the local area as the beach is a vital tourist attraction and the town is built on low altitude soft mudstone so otherwise would be vulnerable to erosion and flooding.
- ❑ I have assessed that the benefits outweigh any negatives down the coast and the schemes are cost effective.

Evaluate the usefulness of primary and secondary data within your investigation (8)

- ❑ I have stated that primary data is collected by myself through a variety of methods
- ❑ I have explained why this helps me to better understand the methods and conditions when the data was collected and that this makes it more reliable and specific to my enquiry question.
- ❑ I have given an example to support this (e.g. the questionnaires were specific to ask people their opinions of the coastal management)
- ❑ I have explain that my primary data is limited by the time it takes to collect and that I was only at the site for one day when the conditions were not the normal weather (which will impact the processes)
- ❑ I have stated that secondary data is collected by someone else and I am using their research.
- ❑ I have explained that this is less specific and we don't always know the methods or context the data was collected through.
- ❑ I have given an example to support this (rightmove houses could be from a range of dates, condition or locations- which we don't know by just looking at the average house price in each location.
- ❑ I have explained that this gives me a wider sample
- ❑ I have concluded that by combining both primary and secondary data my conclusion become more reliable and it improves my research.

Topic 7: People and the Biosphere

Key Terms

Biome
Ecosystem
Diurnal temperature range
Inter-tropical convergence zone
Photosynthesis
Permeable
Impermeable
Weathering
Regulate
Intercept
Surface runoff
Transpiration
Abiotic
Biotic

Exam questions

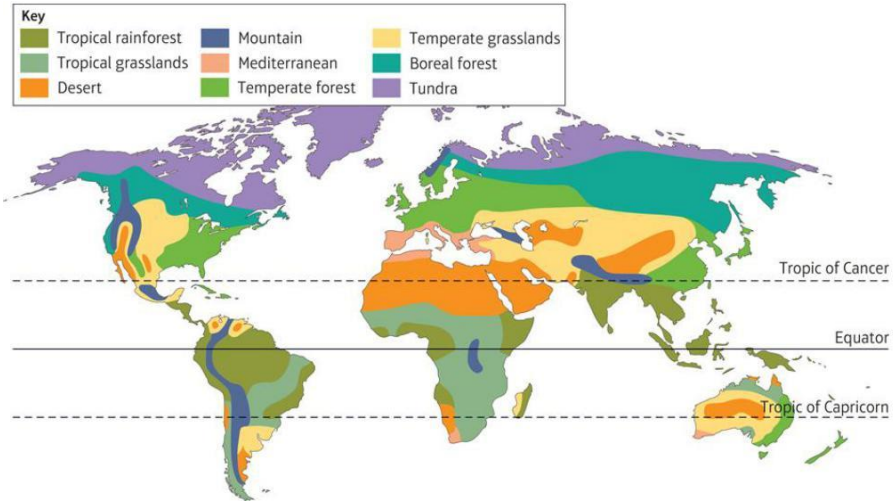
1. State two local factors affecting biomes (2)
2. Describe the distribution of the tropical rainforest biome. (3)
3. Compare the characteristics of tropical rainforest and desert biomes. (4)
4. Explain the difference between bio-physical and bio-chemical weathering (4)
5. Define the term 'biotic' (1)

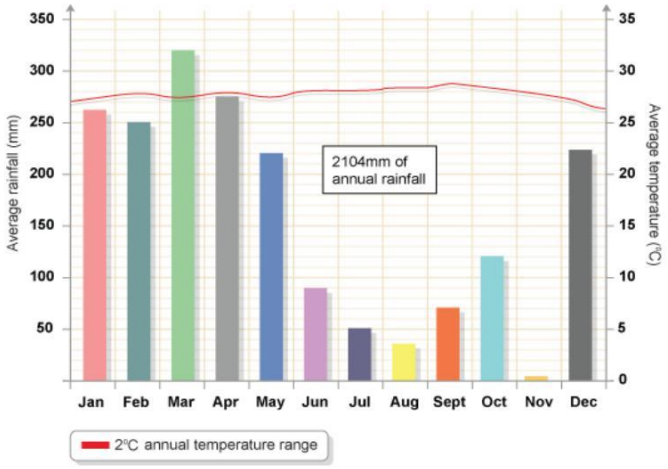
The Earth is home to many ecosystems and their distribution is affected by many factors

Biomes are large scale ecosystems like the tropical rainforest. Distribution is a key concept that describe the location of something—To describe the location of a biome, you can state what the biome is located between, you can add more detail by stating the latitudes it is generally found between and use place location such as the continents. A good description would state any anomalies in the distribution of a biome.

Characteristics—The specific features that allow us to identify how one place/thing differs from another. Differences between the climate and vegetation of biomes—

- Tropical rainforest—Hot all year (25-30°C), wet all year (annual precipitation 200-3000mm). There is dense forest with several layers of trees.
- Tropical grasslands (Savannah) - Hot all year (25-25°C). 500-1000mm rainfall in a year with a distinct dry season. Tall grasses and drought adapted shrubs and trees.
- Deserts—Very hot all year (+30°C), with cool nights (large diurnal temperature range). Low precipitation (>250mm a year). Scarce plants that have water storage features and extensive routes.
- Temperate grassland—Hot in summer (25°C), very cold in winter (as low as –40°C). 500-900mm rainfall a year mainly in spring and summer. Short grasses with very few trees and bushes.
- Temperate forest—Warm summers (18°C), cool winters (5°C). Precipitation all year round with an average 1000mm year. Deciduous trees such as oak.
- Boreal (Coniferous) forest—Mild summers (10-20°C), very cold winters (Below 0°C). Low precipitation (less than 500mm) mainly in the summer.
- Tundra—Temperatures below 0°C for most of the year and only reaching around 10°C in the summer. >250mm precipitation. Mainly lichens and mosses as plants can't survive.





Climatic factors affecting the distribution of biomes:

- Tropical rainforest—Generally occur near the equator due to high solar radiation and rainfall. The sun is generally directly overhead all year and the heat causes the air to rise (warm air is less dense), as it rises it cools, causing the water vapour in the air to condense, forming clouds and precipitation. The low pressure system created is called the inter-tropical convergence zone.
- Tropical grassland—Occur further away from the Equator. They are located where temperatures are still high and there is a distinct dry season that prevents tree growth.
- Hot deserts—Occur along the Tropic of Cancer and the Tropic of Capricorn. A high pressure system is present meaning the air is sinking. As the air sinks it is warmed and can hold more moisture so there is little condensation and cloud formation. This leads to high temperatures during the day. At night it is cooler as the ground does not retain heat very well and there are few clouds to act as a blanket. With little clouds there is little rainfall.
- Temperate forests—Generally located in high latitudes. The atmosphere consists of low pressure systems; the rising air helps create year round rainfall. In winter there is less sunlight so less photosynthesis occurs therefore trees lose their leaves to conserve energy.
- Temperate grasslands—Occur at similar latitudes to temperate forests, but are generally on the interior of continents (away from coasts/large bodies of water). Seasons are more pronounced. They have mild summers and very old winters which limits plant growth.
- Boreal forests– These occur further north than temperate forests, and are generally only located in the Northern hemisphere as there is little land at the same latitude in the Southern hemisphere. The temperatures are colder as there is a high pressure system so the air is sinking. There is also low precipitation. The conifer trees have adapted to the conditions having a waxy coat to prevent freezing and allow quick photosynthesis.
- Tundra biome—Occurs closest to the poles. Plant growth is limited by low precipitation and few sunlight hours. There is a consistent high pressure system here meaning evaporation is slow. Generally, mosses and lichen are the only things that can grow. There are also very high winds as there are few plants to slow it down.

Local factors affecting biomes

- Altitude– The temperature falls by 0.5-1^{o}C for every 100m climb in height. Mountains are also exposed to higher winds making it hard for plants to grow. As slopes are steep they have thin soils preventing plant growth.
- Rock type—Some rocks are hard and prevent growth of plant life and others are soft so roots can easily break through them. Some rocks are permeable allowing water to go through them (Chalk) others are impermeable (Slate). Permeable rocks can encourage plant growth.
- Soils—These are a mixture of rock, dead plants and animals, air and water. Different plants grow in different soil. Sandy soil is extremely permeable and cannot hold water well, plants have to be drought tolerant to grow in sandy soil. Clay soil is slightly impermeable due to small pores; this generally creates puddles that last a long time collecting nutrients. Plants like Wheat grow well in this soil. Chalky soil is permeable and water drains quickly so only plants like barley and grass grow well. Peat doesn't contain rock, it’s made from dead plants and animals. It is rich in nutrients and is acidic. It supports rough grazing and forestry.
- Drainage—If there are impermeable rocks, the surface can become waterlogged creating peat bogs and marshland. There would be very few trees here.

Biotic and Abiotic components interacting:

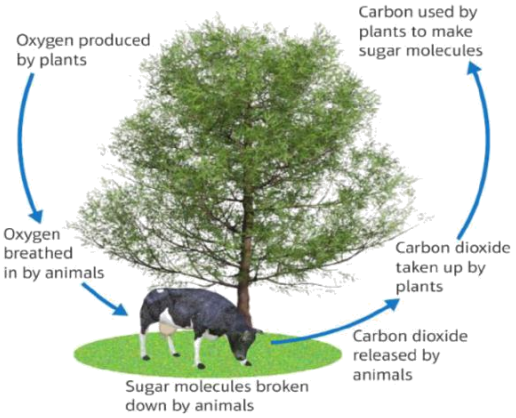
Biotic components are living things like flora and fauna. Abiotic components are non-living parts such as soil, water and climate. These components interact all the time to create an equilibrium.

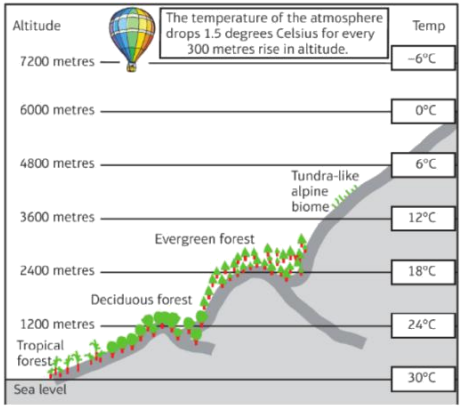
Weathering—When rocks are broken in situ (without being transported). Biological weathering is when living things break up the rock such as tree roots growing in cracks in the rock. Bio-physical weathering is when the rock is physically forced apart such as molluscs that grind holes in rocks to create a home. Bio-chemical weathering is when flora or fauna secrete acids that dissolve rocks. Such as seabirds producing guano which dissolves rocks on cliffs.

Photosynthesis and respiration— Biotic components interact with the atmosphere such as producing greenhouse gases like methane when decomposing anaerobically or digesting. The main way the interact with the atmosphere is photosynthesis and respiration. Respiration takes in oxygen and produces carbon dioxide and photosynthesis takes in carbon dioxide and gives out oxygen. These processes regulate the atmosphere keeping it in balance.

Nutrient cycle—This is how nutrients are transferred in an ecosystem. Soil, litter and biomass are all stores for nutrients. The nutrients are transferred between the stores for example litter decomposition transfers nutrients into soils, as plants grow in the soil they take up the nutrients and become biomass. As the plants die the nutrients go back to being stored in the litter as plant tissue and the cycle continues. Nutrients can be lost in the system through leaching and can be added through rainfall and weathering from rocks.

Hydrological cycle—Plants help to regulate the water cycle, as plants intercept and absorb precipitation, slowing its movement to the ground. This reduces surface run off and the flood risk. At the same time transpiration in the rainforest creates water vapour during the day and at night condensation occurs creating precipitation again. In some biomes like





The biosphere is a vital life support system for people due to its goods and services.

The biosphere provides vital resources—Many people depend on the biosphere for basic goods such as food, medicine, building materials and fuel. Especially indigenous people. All food comes from the biosphere (except salt), but developed cultures tend to farm food rather than forage.

Developed cultures also process food, transport it and store it, whereas indigenous people tend to eat fresh foliage and game they have collected.

Commercial exploitation—Modern technology has reduced our dependence on the biosphere from day-to-day. However, it has also led to increased exploitation of resources. Rapid population growth, modernisation of agriculture, industrialisation and urbanisation has led to a dramatic increase in demand for water. This means that parts of the biosphere is deprived of water. E.g. Hamoun Wetlands in Iran, drought, dam building, irrigation and population growth have caused the wetlands to dry up. Biofuels are also commercially exploited as they are an alternative to fossil fuels. Therefore, huge areas of land are being cleared to grow biofuel crops. This means local's food and fuel prices increase and any indigenous people living in the vicinity could struggle to collect the resources they need for survival. As well as this many habitats are destroyed. For example, the rainforest in Borneo is being cleared to grow palm oil. This is destroying the orang-utans habitat. Even though minerals are not part of the biosphere, the demand for them affects the biosphere. For example, mountain top removal mining, to collect coal developed in the Appalachian Mountains USA, has destroyed many habitats, created mass air pollution and has polluted water supplies.

Biospheres play a globally important role:

Regulating the atmosphere— The main way is through the regulation of carbon dioxide and oxygen in the atmosphere through respiration and photosynthesis. As an equilibrium has been created it prevents the earth plunging into a glacial period as the carbon dioxide keeps the earth warm.

Soil health—Most soils would be infertile if it wasn't for leaf litter decomposing in damp/wet conditions to produce humus. This is aided by earthworms which churn the humus and other dead organic matter to break it down chemically. Soils are vital for human existence to grow crops and the biosphere helps keep them healthy.

Managing water—The hydrological cycle helps prevent flooding and stores water. Mangroves can prevent flooding in coastal locations. Deforestation can reduce interception and absorption leading to increased flooding such as the flooding in Pakistan in 2010.

Questions

Explain how the biosphere provides resources for people. (4)

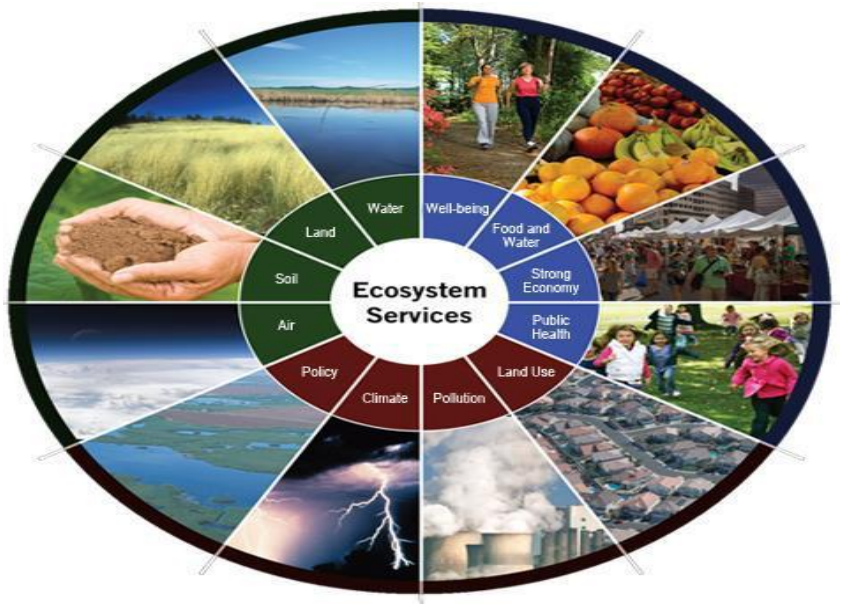
Explain the importance of the biosphere on a global scale. (4)

Explain how increasing resource demand can lead to exploitation of the biosphere. (4)

Explain the difference between Malthus' and Boserup's theories. (4)

Key Terms

Indigenous
Biofuels
Humus
Affluence
GDP per capita
Consumerism
Urbanisation
Industrialisation
Deforestation
Open cast mining
Epidemics
Green revolution
Carrying capacity



Over exploitation—global trends -

The demand for resources (food, water, energy and others) has constantly increased over time. Today we extract 50% more natural resources than 30 years ago (approximately 60 billion tonnes of raw materials a year). The main reason for this is the increasing world population. The natural environment provides us with the resources we need to survive. People in developed countries consume 10x more resources than those in developing or emerging countries.

As significant as the rising numbers of people is the rising affluence of people. Global GDP (gross domestic product) per capita has risen steadily from US$6800 in 1993 to US$13,100 in 2013. This has led to people buying more resources and consuming more than is needed.

Regional trends—Some developing countries are now becoming emerging economies such as Brazil, Russia, India and China (BRIC countries). These countries have grown rapidly. Collectively their GDP surpassed the USA's in 2006, although Russia and Brazil have declined slightly. The newest group of countries that are expected to develop quickly are Mexico, Indonesia, Nigeria and Turkey (MINT countries). As the people in these countries gain more wealth they spend more (consumerism), this means they can access more resources, which in turn means more resources are needed.

Urbanisation and Industrialisation– In the last 50 years' urbanisation and industrialisation have increased, leading to an extra demand on resources. This has directly impacted biomes. A city requires a lot of resources to support its population such as food, water, energy and shelter, however these resources are not always collected locally, they are collected nationally and even globally. This increases pollution, mining, dam building etc. Emerging countries such as China and India have been the major uses of more resources. Again this is due to affluence (a 6-10% annual increase in GDP since 1990). These countries also have large populations and have rapidly industrialised and urbanised. In the next 35 years it is predicted that energy consumption would increase by 56%.

Exploitation -

The demand for resources has continued to increase leading to a lot of damage to the biosphere. Demand for beef (and soya to feed cattle) has led to mass deforestation in the Amazon rainforest. Destroying habitats and indigenous people's homes. The demand for palm oil has encouraged deforestation in Cameroon. Palm oil is used in pizza dough, shampoo, soap, noodles and ice cream. Water is a vital resource to all species therefore dams have been created to store huge volumes of water as well as create electricity with HEP. However, this causes flooding displacing people and habitats such as the Santo Antonio Dam in Brazil which destroyed 400km²or tropical rainforest. Open case mining is also widespread due to demand for fuels and minerals. This has caused a lot of environmental problems in Alberta tar sands in Canada to extract oil.

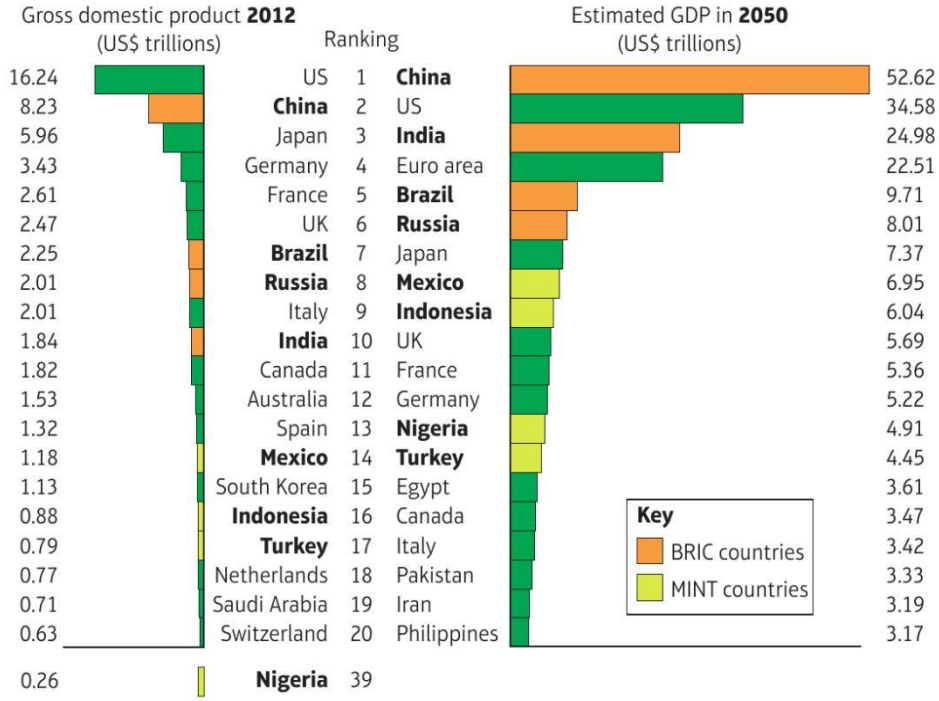


Figure 15 GDP levels in 2012 and projected to 2050

Theories of consumption

Malthus-

Reverend Thomas Robert Malthus in the 18th century wrote an essay about his beliefs that human population would grow faster than resources. Therefore, a disaster may occur. He believed as resources ran out there would be wars, epidemics and famine. This would lead to a crash in the population until the numbers balanced with resource supply. Malthus believed that populations grew geometrically and resources only increased arithmetically. This would lead to the situation in which there would not be enough resources for the global population. The evidence that supports his theory is wars, civil wars which have taken place over resources, as well as famines in Ethiopia and South Sudan due to droughts. Also many diseases have spread such as Ebola and Bird Flu. However, others disagree stating the Green Revolution has allowed us to increase crop yields therefore we can grow more food for the growing populations. Also developed countries have socially changed as they have become wealthier, meaning they have less children on average than emerging and developing countries. This means that in some cases the population is remaining stable or even decreasing such as Japan. Boserup-

Ester Boserup a Danish economist in the 1960's suggested that Malthus was incorrect. She believed that as the population grew to the point that resources were becoming sparse, technology would find ways to increase supply to fit the demand. As the carrying capacity of a country or the world is approached people will find solutions to be supported. The evidence for Boserup's theory includes the Green Revolution which used selective breeding, irrigation, pesticides and fertilisers which has dramatically improved crop yields. Her supporters also argue that the world's population has continued to increase rapidly (over 7 billion today) and there has been no worldwide crash in the world's population due to a lack of resources. The development of renewable technologies has led to a reduction in the need for fossil fuels and cultures are changing to become more sustainable. However, critics suggest that there are still epidemics and diseases spreading such as HIV that is killing a lot of people and there is a growing number of refugees due to disasters such as war, drought and hazards.

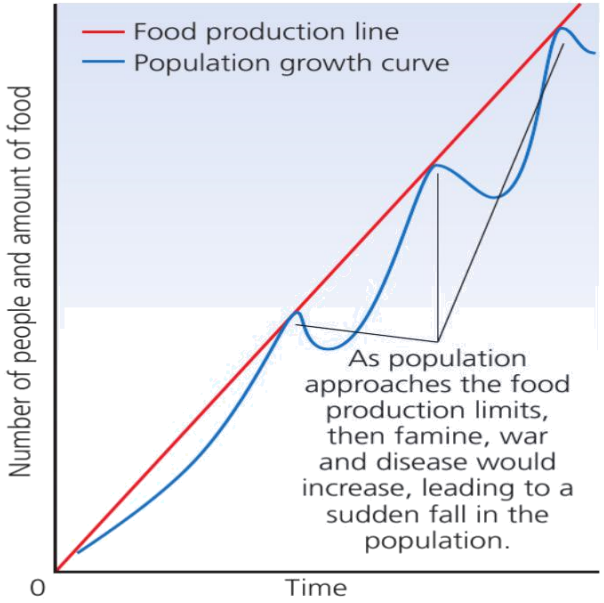


Figure 16 The relationship between food supply and population, according to Malthus

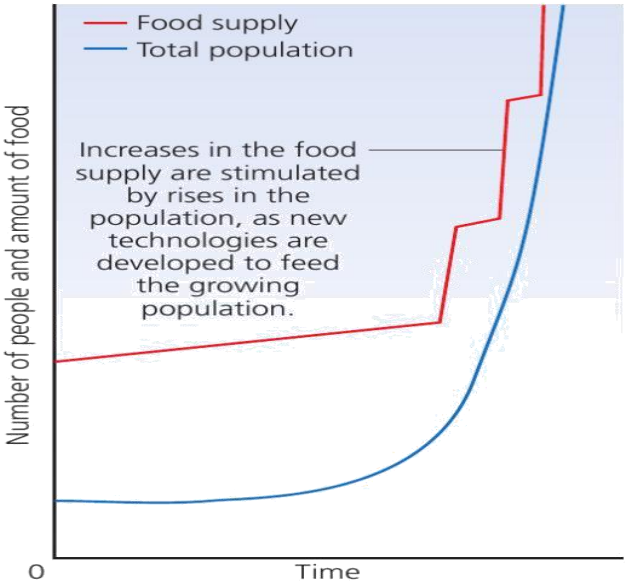


Figure 17 The relationship between food supply and population, according to Boserup

Key Terms

Tropical rainforest
Equatorial climate
Abiotic
Ecosystem
Biotic
Nutrients
Nutrient cycle
Soil
Litter
Biomass
Leaching
Biodiversity
Emergents
Canopy
Prehensile

The structure, functioning and adaptations of the tropical rainforest reflect the equatorial climate (biotic and abiotic components, biotic adaptations, nutrient cycles)

Most tropical rainforests are located between 20° north and south of the Equator. This zone has an equatorial climate. This means it is hot all year round with average temperatures of 27-20°C and never falls below 20°C. There is precipitation all year round with annual precipitation rates of 2000-3000mm a year. These conditions are ideal for plant growth.

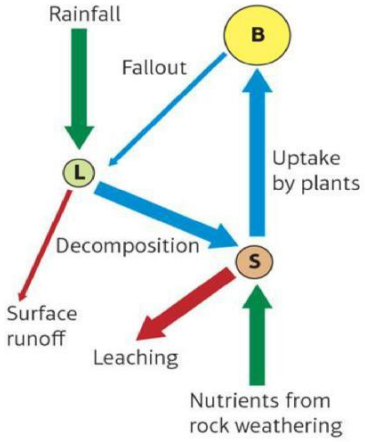
The non-living components of the tropical rainforest ecosystem such as soil, climate and rocks are the abiotic components. The living things such as plants and animals are the biotic components.

The nutrient cycle describes how nutrients are transferred around an ecosystem. It has 3 stores: litter, soil and biomass. Nutrients are transferred between these stores. The biggest store is the biomass which is made up of all the biotic components. When the leaves fall and enter the litter store they decompose quickly so the nutrients are transferred into the soil. The plants then absorb these nutrients.

Due to the constant precipitation a lot of water travels through the soils, as it does this it takes nutrients and minerals with it. This is called leaching. This makes the soils low in nutrients.

The tropical rainforest has a very high biodiversity. This is because the conditions for plant growth are so good allowing the ecosystem to support thousands of species. As well as this, the ecosystems have developed and evolved over thousands of years.

An example of a nutrient cycle diagram

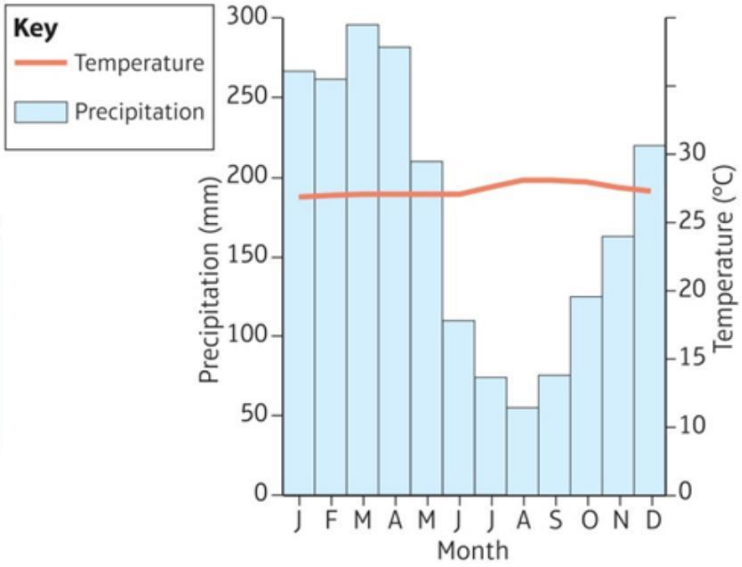


Key

The size of the arrow indicates the amount of flow

- L Litter store
- B Biomass store
- S Soil store
- Nutrients in
- Nutrients out
- Nutrients transfer

As plants and animals die, their tissues fall into the litter store.
As living tissue decomposes, nutrients are transferred to the soil store.
Some nutrients are lost from litter by surface runoff.
Plants take nutrients from the soil. This is very rapid in the TRF.
Soil loses nutrients by leaching



Questions

1. Explain one way how plants are adapted to the equatorial climate (2)
2. Identify two ways in which the chameleon is adapted to the challenges of the tropical rainforest environment. (2)
3. Explain why Madagascar's rainforests have high levels of biodiversity. (4)

Plant adaptations

The main challenge for plants in the rainforest is competing for light. Some trees have adapted to grow extremely tall (50m+) called emergents. Trees below this form the canopy layer and are between 30-40m high. If a tree falls and dies, a light patch will appear and tree saplings will race upwards to the light and the gap is filled by the winner which spreads its branches and leaves out to collect as much sunlight as possible. A second adaptation is drip-tip leaves which means water can run off them quickly. If this did not happen moss and algae would grow quickly over the leaf surface blocking its ability to absorb sunlight. Another adaptation is buttress roots. As the soil in rainforests is very thin and the nutrients are concentrated at the top of the soil, the roots of the trees have evolved to be tall, slender and shallow to collect what they need to grow.

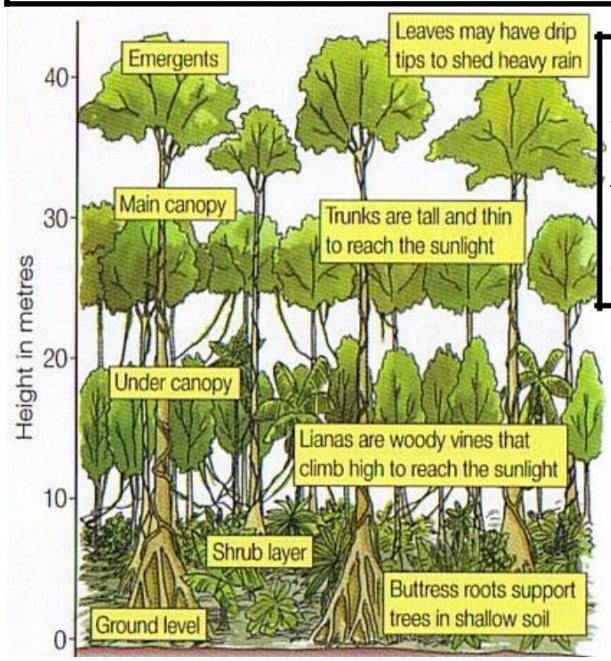
Animal adaptations

Due to the abundance of plant life in rainforests, animal life thrives. In the Madagascar rainforest it is estimated that 14,000 plant species support 250,000 known animal species, of which75% are not found anywhere else in the world. The animals have adapted in many ways:

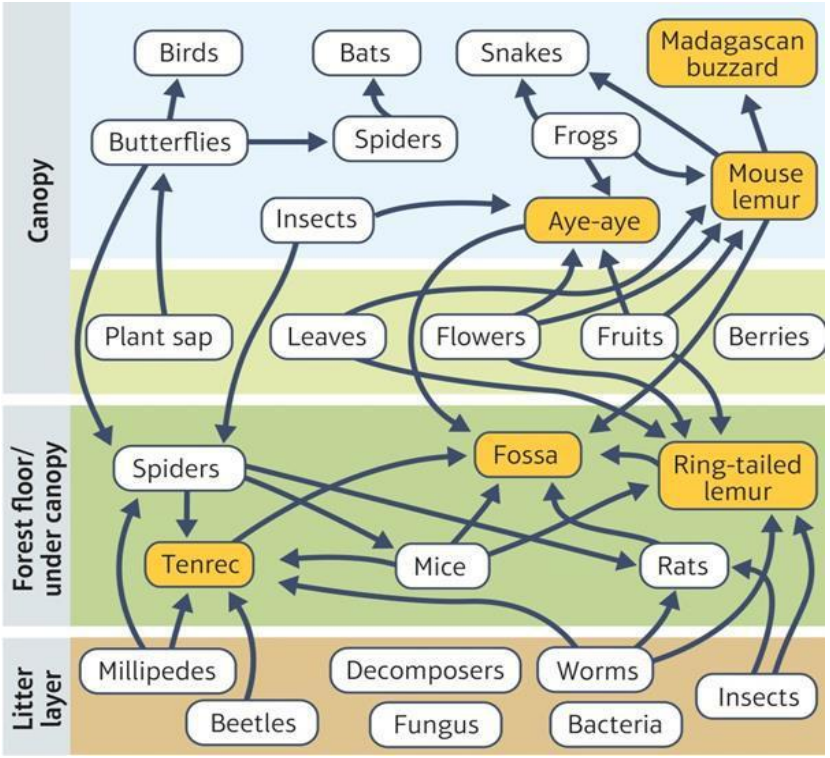
· As plants flower and produce fruits at different times of year, animals (specifically monkeys) have adapted to travel through the canopy. They have gripping hands and feet, long prehensile tails for balance and coloured vision to identify if fruits are ripe.

· Birds have also evolved such as eagles, these have powerful legs and clawed talons that can grab monkeys from the canopy.

· Some animals like chameleons' camouflage to avoid being eaten.



Food webs are a type of diagram used to show who eats what in an ecosystem. These are highly complex in tropical rainforests due to high biodiversity and due to the different layers in the rainforests there are mini-ecosystems with their own food webs.



Tropical rainforests are threatened directly by deforestation and indirectly by climate change (Causes, Effects, Climate change)

Deforestation happens as the forest is converted into farmland. Trees are cut down either to sell as timber, provide space for open-cast mining and HEP schemes. Deforestation, logging and mining are direct threats to the rainforest. Deforestation causes

- Commercial agriculture—this is when crops are grown to sell at a profit. This is the main cause of deforestation in the tropical rainforest (75% deforestation in Brazil is for cattle farming). In recent years the rainforest has been cleared to grow sugarcane to export. Deforestation in the South East Asian countries is mainly to clear land for palm oil plantations. These crops are in high demand as they are biofuels.
- Subsistence agriculture– this is when people farm to feed their families. A small plot of trees is felled and burnt so crops can be planted. Leaching is a big problem because of this as the nutrients in the soils are washed away during any precipitation. Poorer farmers resort to 'slash and burn' as no money is needed to clear the land which creates a lot of pollution. In the past land would be left barren for a long period of time after being used for crops. However as the population is growing more and more land is being cleared for families and plots are having to be used straight away.
- Commercial hardwood logging—many countries are participating in commercial logging to earn money to pay off interest on international debts. A lot of countries have strict controls on logging however it still occurs illegally on a large scale due to demand. Chinese buyers will pay high prices for hardwood timber such as rosewood. Poverty is another reason why logging is high in tropical rainforests. Logging companies pay very well so locals take the jobs even though is illegal. The police and government are generally aware of illegal logging but allow it due to corruption
- Mining—valuable minerals can be found underneath the tropical rainforest so open-cast mines are created to extract the minerals. This means huge areas of forests are lost for the mines and roads created. The roads encourage farmers to settle in the rainforest and clear the land for crops (approx. 15% deforestation is linked to mining and road building).
- Fuelwood—The indigenous people of the rainforest use the trees as fuelwood.

Climate change

Climate change is an indirect threat to the rainforest meaning there is no direct cause between one thing and another. The Earth's atmospheric temperature is increasing which is affecting the atmospheric circulation systems that bring wet seasons to the equatorial climate. The warmer temperatures mean that the rain belt moves polewards and the rainforest receives less rainfall. This means the rainforest may suffer with drought conditions and many areas will become seasonal tropical forests. Temperatures in the tropical rainforest are similar all year round and many species will not be able to adapt to any change in temperature or lack of rainfall. The flying fox bats have been dying due to heatwaves as their bodies cannot cope with the change in temperature. There is a higher risk of forest fires as plants and trees dry out in the heat. As large areas dry out, drought tolerant species would out-compete the rainforest species. This would lead to ecosystem stress in which the plants and animals would have a lower tolerance to pests and diseases.

Key Terms

Commercial agriculture
Subsistence agriculture
Logging
Deforestation
Mining
Fuelwood
Direct threats
Indirect threats
Ecosystem stress

Questions

Explain why rates of tropical rainforest deforestation are rising in some areas but falling in others. (4) Explain the difference between a direct threat and an indirect threat. (2)

Assess the severity of threats to the tropical rainforest (8) Identify 3 ways the TR is being deforested (3)

Conservation & sustainable management of tropical rainforests is vital if goods & services are not to be lost for future generations

(Advantages/disadvantages of CITES, REDD, sustainable forestry, ecotourism)

Key Terms

CITES
REDD
Remote sensing
Sustainable rainforest management
Ecotourism

Questions

1. Select the conservation strategy that you think would be best for the tropical rainforest biome. Justify your choice. (8)
2. Why do people in Japan, China, USA and the UK have a role in reducing deforestation? (3)
3. Several options exist for conserving the tropical rainforest in a sustainable way. Three possibilities are:

a.) Create a national park area
b.) Use remote sensing to monitor human activity

c.) Use CITES and REDD Select the best option you think would be best to manage the tropical rainforest (12+4)

Global Actions

CITES (Convention on International Trade in Endangered Species of wild fauna and flora) and REDD (Reducing Emissions from Deforestation and forest Degradation) are international organisations that have made agreements to protect the tropical rainforest. Countries sign up to these agreements and receive aid and assistance.

- CITES - The main aim is to prevent the trade of endangered animal and plant species across the world. Especially if it threatens the rainforests biodiversity. There are currently 35,000 species listed under CITES protection. There are different levels of protection. Countries have to agree to monitor trade across their borders and punish people importing or exporting products from endangered species if they sign up to CITES.
- REDD—The is a UN (United Nations) scheme that advises governments on how they can reduce deforestation and promote afforestation. Remote sensing is used to monitor deforestation rates. It receives funds from sources such as

Organisation	Advantages	Disadvantages
CITES	181 countries have signed up to it It is targeting the issue	Illegal trade is increasing as demand is high. It cannot manage all 181 countries.
REDD	International expertise is on hand to help tackle deforestation. Funding is attractive to governments	Deforestation is still happening at a rapid scale in South Asia. It is vague about what afforestation means and allows crop plants to be grown instead of native plants.

Local Actions

Amazon, Brazil—There are several reasons why deforestation rates reduced in Brazil between 1994 and 2013. Pre 2005 deforestation rates were high due to the demand for soya beans so land was cleared to create crops. However, the international price of soya beans dropped in 2005 and so the demand fell. Also, environmental groups used this time to push TNCs to only buy sustainably-grown soya beans. At the same time the Brazilian government increased its commitment to REDD. This was helped by a billion-dollar fund from Norway. The protected areas in the rainforest were expanded and laws against deforestation were enforced by the government and police. Challenge of Sustainable forest management

An alternative method to protect the rainforest is sustainable rainforest management. This aims to prevent damage to the rainforest so that it benefits local people. This combined with ecotourism can create jobs for locals as guides and in hospitality. The tourists are encouraged to buy handcrafted products from locals. This means locals do not illegally log or trade in animal or plant species. The scheme also educates locals on how to live more sustainably such as higher yielding crop use so less land needs to be used. The issue is most of the sustainable management methods require funding to survive, as well as this the schemes only really work in areas that are already protected such as National parks.

The taiga shows different characteristics, reflecting a more extreme and seasonal climate.

(biotic and abiotic components, biotic adaptations, nutrient cycles)

The largest biome on the Earth's surface is the taiga biome. It stretches from 50°N to 70°N across North America and Asia. The climate of this region is known as the subarctic climate. This is dominated by very cold, dry and long winters with average temperatures of –40°C. Summer months have mild temperatures and are short, the average temperature is 16°C. There is normally snow on the ground for the whole year, the annual precipitation rate is low with less than 500mm a year.

In comparison to the tropical rainforest the taiga has a lower productivity in terms of nutrients and a lower biodiversity. The taiga growth period is short due to a short summer this makes the biomass small, decomposition is slow due to the low temperatures and can even stop during the winter months. Because of these conditions only a few species are adapted to survive leading to low biodiversity.

Nutrient cycle—The biomass and soil stores are small and transfers of nutrients between the stores is low. The biggest store is the litter store, this is mostly made up of pine needles which are tough and decompose slowly. Due to the slow decomposition it takes a long time for nutrients to enter the soil. This means the soil cannot support a large amount of biomass. The pine needles that become litter are acidic therefore the soil becomes acidic which again limits the species that are able to thrive in the taiga environment. Generally, only coniferous species can survive along with mosses, lichens and fungi. With fewer plant species there is also fewer animal species. Most of the animals that live in the taiga environment have migration routes. Birds are very common due to lots of insects available.

Key Terms

Biome
Subarctic climate
Productivity
Migrating
Food webs

Questions

1. Identify the largest store in the taiga nutrient cycle (1)
2. Explain how the process of leaching removes nutrients from the taiga ecosystem (2)
3. Explain (using the nutrient cycle) why the taiga forest is considered to be a fragile ecosystem (4)
4. Explain how plants are adapted to the taiga ecosystem (4)
5. Explain how animals are adapted to the taiga ecosystem (4)

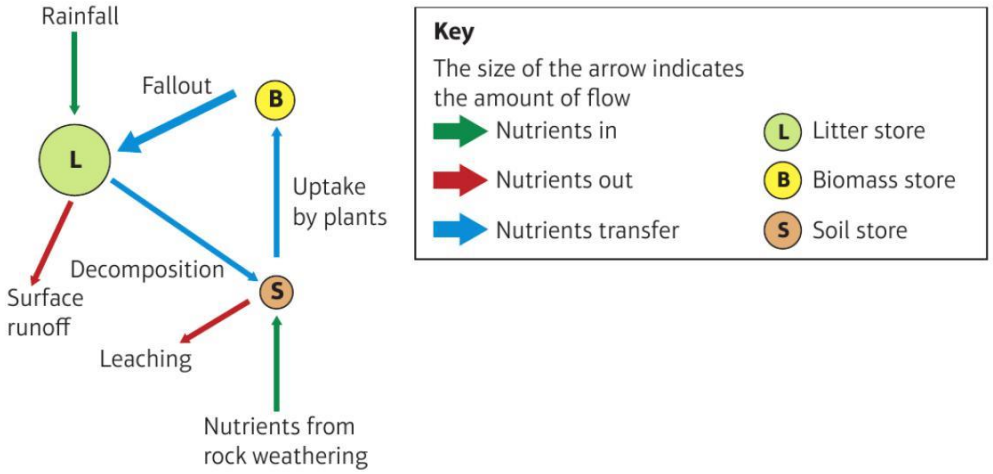
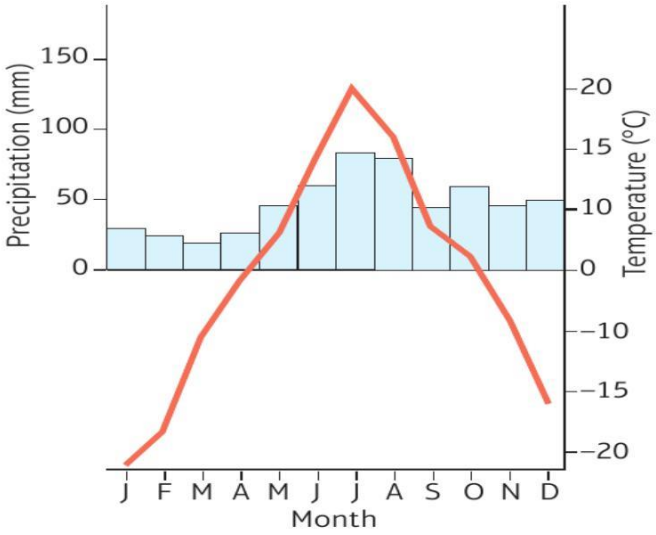


Figure 3 The nutrient cycle of the taiga



Plant adaptations Taiga forests are usually full of conifer trees. These trees remain green all year round as they do not drop their leaves as they do not have the energy to regrow leaves each year. As well as this the trees need to be ready for photosynthesis to occur in spring. Conifer trees have specially adapted leaves which are needle shaped called pine needles. They are this shape so they have a small surface area so they lose less water from evaporation. They also have a waxy coating to help reduce water loss. The needles are a dark green colour so they can absorb as much sunlight as possible so they can photosynthesise. The needles contain only a little amount of sap so they do not freeze easily and can operate in cold conditions. There are only a few conifer species in the taiga ecosystem and they grow close together to gain protection from wind damage. Most are conical shaped with downward facing branches, this is so heavy snow falls off quickly.

Animal adaptations

Due to seasonality in terms of the climate there is also seasonality with animal life. During the summer months the taiga has a large amount of animal populations, this drops dramatically in winter. The Canadian taiga has over 300 bird species in the summer however, only 30 stay during the winter as many migrate south. They migrate to the taiga in winter due to a lot of insects. The animals that stay in the taiga all year round are specially adapted to live there. They generally have thick fur coats for insulation, smaller ears, noses and short tails to reduce the chance of frost bite. Many animals also hibernate during the winter months; they build up a large layer of fat during the summer months so they can go into a sleep-like state. Some animals develop a white coat during winter months to camouflage better.

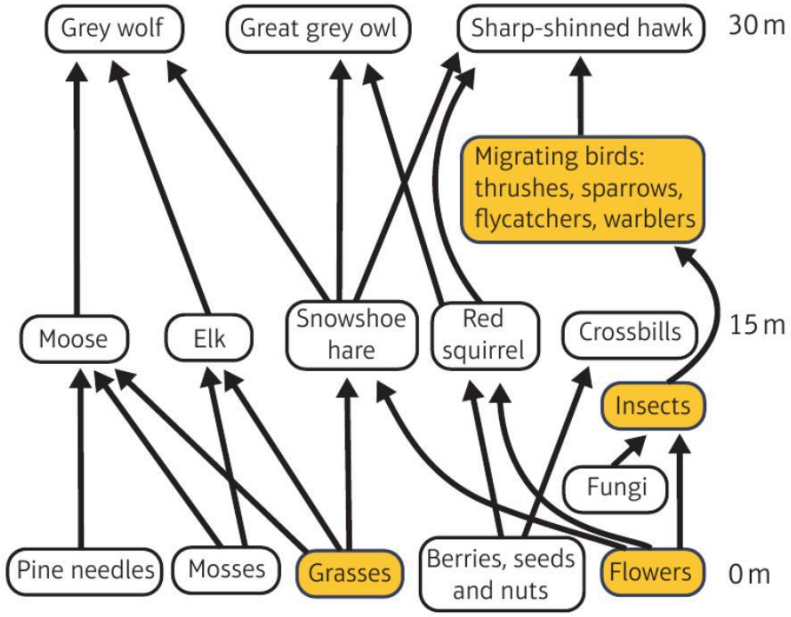


Figure 8 A food web for a Canadian taiga ecosystem

Food webs

The food webs in this ecosystem are much simpler in comparison to the rainforest as there is a lower biodiversity due to the climate. There is a limited amount of plant species, the trees are roughly the same height and only have one layer. The forest floors have little undergrowth and the soils are generally shallow with few nutrients. It is very dark due to conifers growing very close together. There are few reptiles and amphibians as they are cold blooded and they struggle to find heat in this environment. The few large mammals in the taiga have large territories and spend most of the summer building up their fat reserves.

The taiga is increasingly threatened by commercial development

(Direct threats and indirect threats, acid precipitation, forest fires and biodiversity loss)

Commercial development is a direct threat to the taiga environment. This happens when an area has valuable resources that can be sold to make money. The threats to the taiga can be classed as direct or indirect. Direct threats include logging as it removes trees that are a key biotic component of the ecosystem. An indirect threat is mining, HEP and oil and gas extraction as they damage the taiga due to their side effects such as flooding, pollution and oil spills.

Deforestation is high is the taiga environment due to the softwood available. They use a clear cutting method to collect the timber, this is where all the trees in an area are cut down and transported to sawmills to be cut into useable timber for construction and trees are turned into a pulp. Russia has a huge deforestation issue as huge amounts of forests are being cleared (average 12 million hectares a year in 2014). As much as half of the logging is illegal. This is a huge threat to the taiga as the plants that are logged are not replanted. In Canada the government controls logging and ensures that any trees felled are replanted.

Oil and gas extraction is another threat to the taiga in Russia as 20% of the world's oil and gas reserves are found here. Greenpeace an NGO (Non-governmental organisation) that campaigns environmental issues states that Russia's oil industry spills 5 million barrels (795 million litres) of oil each year through accidents and leaks. This affects the animals and people that live in the area. In contrast Canada which also have oil and gas reserves controls the extraction still have the occasional oil spill e.g. in 2011m, 5 million barrels' bitumen (oil) mixed with water spilled due to a broken pipeline in Alberta. Due to the poor drainage systems in the taiga environment the oil is not easily washed away and as well as this decomposition occurs very slowly therefore the oil remains in the ecosystem for a long time this can kill the roots of the trees.

Acid precipitation—This occurs when fossil fuels are burnt in industries, chemicals such as sulphur dioxide are created and are released into the atmosphere (Volcanoes also do this). When this reacts with water and oxygen it forms an acid which can form acid precipitation. The most damage that is caused is when the acid gets into the soils, lakes and ponds. Acidic water kills insects and their eggs, this means there is less food available for migrating birds. Microbes in the soil are killed therefore nutrients cannot enter the soil. As a result of this the plants become weaker and they become less resistant to changes in temperature, forest fires and pests and diseases.

Forest Fires— Natural causes of forest fires are lightning strikes. Most fires are caused by humans such as hunters lighting camp fires and gas flares in oil fields. The taiga is adapted to forest fires as the ash left after a fire is nutrient rich which plant species benefit from. The problem is naturally the forest is adapted to fires every 80-100 years, however they have become much more frequent as global temperatures have increased and saplings are burnt before they can replace the old trees.

Pests and diseases– The taiga has mould and fungus species that damage the needles, trunks and roots of conifer trees. Insects also eat the pine cones, young leaves and the saplings. As well as this other pests and diseases have migrated into the taiga biome as the temperatures have increased. The damage is happening on a large scale for, example the silkworm which spread into eastern Siberia from Mongolia in the early 2000s killed many plants it didn't help that the area was also suffering from forest fires and droughts. Plagues of spruce-bark beetles have killed large numbers of taiga trees in North America. In Alaska's forests over 6 million acres have showed signs of spruce-bark beetle activity.

Key Terms

Direct threat
Indirect threat
Acid precipitation
Forest fires
Pests
Diseases

Questions

1. Describe one direct threat and one indirect threat to the taiga caused by commercial development (2)
2. Assess the severity of the threats to the taiga biome (8).
3. Explain the process by which pollution can produce acid precipitation downwind of the source. (2)
4. Explain one way in which acid precipitation is a threat to the taiga forest. (2)
5. Explain why climate change could intensify the threats to the taiga forest. (4)

The taiga wilderness areas need to be protected from over-exploitation

(National parks, Sustainable forestry, conflicting views)

The taiga is a fragile ecosystem and takes a long time to recover from damage. Due to the long cold winters and lack of nutrients vegetation grows slowly. As well as this, decomposition is slower so any pollution remains in the ecosystem for a long time. Species diversity is low in the taiga environment therefore if a disease affects one species it has a big impact on the whole ecosystem. The flora and fauna in the taiga would struggle to adapt to any changes, especially climate. Protected wilderness areas and National Parks can be created to prevent commercial development of the taiga within their boundaries. The aim of a National Park is to preserve the taiga environment and its biodiversity. Researchers find out as much as they can about the biotic and abiotic components of the ecosystem to inform the public and local government about its importance. In contrast protecting 'wilderness' areas is more proactive as it is active ecosystem management, rather than just leaving the area wild. One example of active management is culling elk as there is not enough predators to keep their numbers down, so rangers will kill a small percentage of the population. If there are too many elk in an ecosystem it prevents saplings growing into trees as they are eaten. There are not enough predators in the taiga ecosystem as they need large territories to survive and the National Parks and wilderness areas are generally not big enough. Any predators that range outside the National Park areas are not protected and are therefore at risk of being poached or trapped by farmers who see them as a threat. Licenced hunting keeps many predator populations down. National parks also want to attract tourists to educate about the environment, however tourists want to see big predators and the predators want to seek more remote areas away from humans. National parks are popular tourist destinations as well as conservation areas. E.g. Canada's busiest National park Banff has 3-4 million tourists visiting each year. Some are winter tourists that go to ski and sledge. All the tourists that visit the taiga ecosystem damage the ecosystem they come to enjoy through footpath erosion etc. Human-wildlife conflict occurrences can also happen such as grizzly bear attacks.

Sustainable Forestry—This is when trees are cut down and are replanted with native taiga species. The whole forest area is carefully managed so that the biodiversity is not lost. Forest corridors are created to allow species migration and the areas are preserved. Sustainable management is expensive and requires long-term planning. This is usually only possible for large companies or when international organisations provide funding.

Conflicting views—Many different groups of people have an interest in how the taiga is used.

Forestry — Countries like Canada have strict controls on logging and timber can only be used sustainably. However in some countries like Russia are unsustainable when it comes to forestry.

Mining and Energy production– Without mining and energy production Russia and Canada would be very poor, for example 380,000 Canadians work in the mining industry.

Indigenous peoples—They want to maintain aspects of their traditional uses of taiga resources, such as hunting.

Recreation and tourism—In North America and in Russia they go to the taiga environment to relax as well as this international tourism also brings visitors and money to the local economies.

Key Terms

Over-exploitation
Commercial development
Territories
Sustainable forestry
Indigenous people
Recreation and tourism

Questions

1. Explain two reasons for conflicting views on protecting or exploiting the taiga (4)
2. Evaluate the obstacles that limit the effectiveness of global strategies aimed at conserving forest biomes (8)
3. Why might people living in forested areas of the world be against establishing national parks? (4)
4. Which do you think is in more need of protection the rainforest or taiga forest? Give reasons (6)

Other challenges include:

1. Migration
2. Money
3. Pollution

Topic 9: Consuming Energy Resources

Key Terms

Fossil fuels
Non-renewable
Renewable
Recyclable
Stock Resources
Flow resources
Fracking
Bitumen
Groundwater

Energy resources can be classified in different ways and their extraction has consequences

We can classify energy sources as non-renewable, renewable and recyclable.
Fossil fuels (non-renewable resources) have fuelled economic development since the industrial revolution, whilst causing significant environmental damage. Over 86% of the world's energy come from fossil fuels in 2014, such as coal, oil and gas. Non-renewable resources are finite or stock resources meaning no more are being created and they will eventually run out.
Renewable energy resources are energy sources that will never run out such as wind, solar, tidal, geothermal and hydro-electric power. These can also be known as flow resources. Only 9.3% of the world's energy is created using renewable sources.
Recyclable energy resources can be reused into the future such as biofuels and nuclear power, where the uranium fuel is reprocessed and used again.
Overtime the worlds energy demand has increased and the balance of energy types has changed.

What impact does extracting energy have on the environment ?

One of human's biggest and most significant impact on the environment is extracting and using energy. The impacts can vary by scale such as locally in terms of aesthetics, regional—air pollution and globally with the rising threat of climate change.

The impacts of drilling:

- Landscape scarring
- Carbon emissions
- Oil spills
- Deforestation
- Migration patterns impacted

The impacts of mining on the environment:

- Landscape scarring
- Carbon emissions
- Deforestation
- Migration patterns impacted

The impacts of HEP:

- Flooding
- Landscape scarring
- Deforestation
- Migration patterns impacted

The impact of wind turbines:

- Landscape scarring
· Migration patterns change for birds

The impacts of solar energy:

- Land use
- Potential deforestation
- Landscape scarring

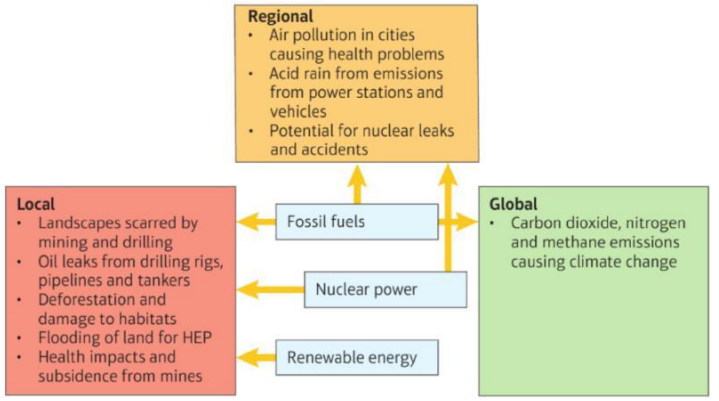


Figure 5 The impacts of energy production and use on the environment

Exam questions

1. State the 3 types of energy resources (3)
2. Explain the views on oil extraction of different groups of people. For example consider the government, an oil company, businesses and industries, local people and an environmental pressure group in your answer. (8)
3. What impacts on the environment are caused by exploiting energy and by using energy? (4)
4. Compare the impact of nuclear power, fossil fuels and renewable energy on the environment (6)

Key Terms

Reserves
Geology
Relief
Climate
Accessibility
Development
Biomass
Economic Development
Economic sectors
Traditional fuel sources

Questions

1. Explain why the USA may be concerned about oil supply in the future. (2)
2. Explain why falling oil prices may affect Saudi Arabia's economy. (2)
3. Explain 3 factors that can affect the distribution of energy resources (6)
4. Explain what causes a variation in energy use around the world (6)
5. Explain why energy use has changed over time (3)
6. Which regions consume the most energy? (3)

Access to energy resources is not evenly distributed which has implications for people.

Accessibility to energy resources across the world are uneven. Countries that have fossil fuel reserves have become very wealthy and dominate the energy supply. There are three main factors that affect the uneven distribution in energy: Geology—

- Sedimentary rocks contain most of the world's fossil fuels. The Middle Eastern countries such as Saudi Arabia and Iran have 48% (2012) of the world's oil and 43% (2012) of gas reserves. Coal is widely distributed around the world. Most of the reserves are in Russia, USA and China.
- Geothermal energy is generally only accessible in areas close to plate boundaries such as New Zealand and Iceland. The volcanic activity creates heat stored in magma beneath the Earth's surface, creating a natural geothermal system which can be used to heat water and generate electricity.

Relief and climate—

- Regions with high rainfall and suitable relief are often good locations for HEP. A large volume of water is needed, and steep sided valleys are often chosen for dam construction.
- Climatic are also important to harness the potential of wind and solar power. Areas exposed to high winds are good for wind farms and places that receive long hours of sunshine are good for solar farms.

Accessibility and Development—

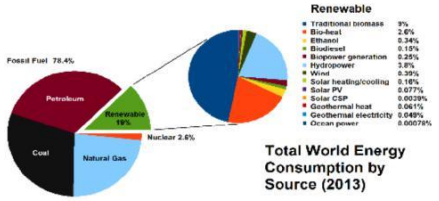
- How economically developed a region is influences its ability to invest in new technology? Some resources are in remote regions making them expensive to exploit. Many developing and emerging countries use biomass for energy.

Variations in energy use:

Economic development— For countries to develop economically energy is vital to power industry, transport, information technology as well as heating and cooling buildings. The countries with the highest demand for energy are developed countries so they are able to invest in technology. This investment in technology creates new opportunities for energy supplies from renewable and recyclable sources as well as other non-renewable sources such as fracking. However, developing countries have limited access to energy resources as well poor distribution systems. This restricts economic growth.

Economic Sector— With a changing economy and technology the type of energy use changes. Most energy in developed countries is for transport. Little energy is used for farming. In contrast developing and emerging countries use most of their energy for industries and farming.

Traditional fuel sources – Traditional biomass fuels are used for domestic use in many rural areas in developing countries. In some regions such as the Sub-Saharan Africa there is no direct electricity source and in urban areas the supply can be inconsistent. Although Africa is rich in fuel sources access to them is limited, over 700 million people still cook over open fires.



Global patterns of energy use:

Population growth in the last 100 years as well as rising incomes has increased the demand for energy. It is expected that an extra 1.6 billion people will need energy by 2035, demand will also grow as countries can become more economically developed.

The global demand for oil is increasing, but supplies are unevenly available

Oil production is one of the world's largest businesses, some of the largest TNCs are oil companies. The distribution of oil like all other fossil fuels is uneven. At present the Middle East has the largest oil reserves with an estimated 804 billion barrels of oil left. This should last approximately 200 years. The top 3 producers of oil are USA, Russia and Saudi Arabia all producing over 10 million barrels a day. Most new oil resources are found in hostile locations or far away from world markets.

Since the 1990s the global consumption of oil has been rising as the demands have increased due to a wealthier population. Rapid industrialisation and development in emerging countries has been one of the biggest factors contributing to a higher consumption of oil, especially in countries like China, where oil consumption has trebled since the 1990's. China accounts for 12.4% of global oil consumption in 2014, however the USA takes the lead with 20% of the world's oil consumption. Over 70% of oil consumption is used in transporting goods and people. On average over 1000 barrels of oil are consumed a second. The price of oil per barrel has fluctuated a lot since 1983. There are many reasons for fluctuating prices that can be local factors of global factors such as:

- An increased demand for oil due to the growth of the world's economies leading to a long term rise in the price of oil up to 2008.
- Emerging countries such as China going through rapid industrialisation in the early 21st century increased the demand for energy, which Chinas own oilfields could not meet. Imports had to fill the gaps.
- The price of oil fell during the global recession in 2008 as the demand for oil fell as consumers brought less goods.
- Disruptions to supply such as the oil spill in the Gulf of Mexico in 2010 by BP led to a price hike, as well as political events in the Middle East.
- Diplomatic relations and conflict between countries can lead to high prices.
- The discovery of new sources such as shale gas increased the supply and led to lower fuel prices.
- Long-term rising demands lead to pressure on oil supplies and prices.

Exam Questions

1. Describe the distribution of global oil supplies (4)
2. Explain how conflict between countries can affect global oil prices. (4)
3. Explain what is meant by energy security (2)
4. Evaluate the advantages and disadvantages of the East Siberia-Pacific Ocean pipeline to China and Japan (8)
5. Explain the long-term and short term factors that can lead to world oil price changes (6)
6. Explain why demand for oil has increased since the 1990s (4)

Key Terms

Consumption
TNCs
Conflicts

The East Siberia-Pacific Ocean (ESPO) geopolitics of oil

- Due to China and Japans limited energy supply they are keen to access Russian oil to have better energy security. This will reduce their dependence on Middle Eastern oil which makes them vulnerable to price increases.
- For China's rapid economic growth, a reliable energy supply is essential. 60% of China's oil imports come from the Middle East, transported through the Strait of Malacca, which is subject to attacks by pirates. As China wants to expand its energy supply options, Russia is its best choice, however the diplomatic relationship between Russia and China is not smooth. Russia believes China is a threat so is unwilling to supply large quantities of energy. China is also wary of Russia as they know Russia has a history of switching off energy supplies with countries such as Ukraine when relationships become strained.
- Japan is the 3rd largest oil consumer in the world, however it has limited supplies, hence it is interested in Russia's supplies. Most of Japans oil comes from the Middle East so therefore the ESPO line will reduce its dependence on Middle Eastern oil. The Japanese government offered finance to extend the ESPO pipeline closer to Japan and by 2010, Russia's exports to Japan increased rapidly.

Key Terms
Extracting
Isolated
Fracking
Groundwater
Bitumen
Contamination

The world's continuing reliance of fossil fuels increases pressure to exploit new areas

New Conventional oil and gas source—Exploring and Extracting in the Arctic

- Most of the accessible oil and gas fields had already been discovered and exploited by the late 20th Century. Demand for oil has increased in the 21st century meaning scientists are searching for new resources in increasingly remote and delicate environments such as the Arctic.
- Along the coast of the Beaufort Sea (an isolated region), Exxon Mobile Corporation has been constructing a natural gas extraction facility on flat marshy land which is said to cost US$4 billion. The reason for this is distance the gas needs to travel from Point Thompson to the Badami oil field which is 35Km away.

Unconventional oil and gas source

Questions

1. Describe two impacts of extracting oil from tar sands (2)
2. Explain why it is expensive to drill for oil and gas in the Arctic (4)
3. What are the economic benefits to Arctic countries of developing oil and gas production? (6)
4. Explain why companies have invested in extracting oil from difficult environments like the Athabasca tar sands (6)
5. Explain why there might be opposition to fracking in a UK National Park (6)

Costs

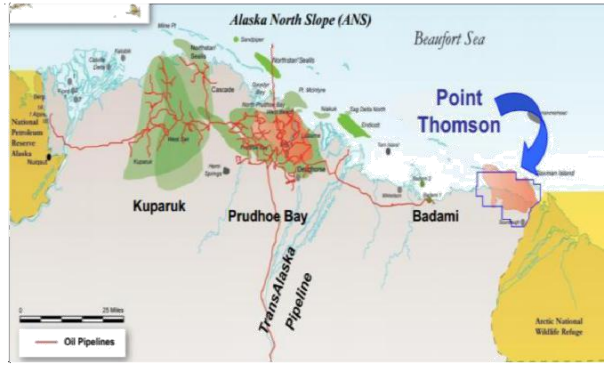
- The cost to make the facility is US$4 billion—the remote location might make it cost more.
- There have been many accidents and leaks.
- Any damage created in this environment lasts centuries.

Benefits

- Exxon estimates that the facility will produce 10,000 barrels a day.
- There is approx. 35 billion cubic feet of discovered gas.
- It will provide employment for up to 800 people.
- The state of Alaska will take a 25% share and investing $5.25 billion for the project which is said to be worth $45 billion.

The USA developed the process of fracking to collect natural gas. The fracking process involves drilling into shale deposits and injecting water, sand and chemicals at high pressure into the rock. This frees the natural gas from the rock and allows the gas to flow upwards where it flows into a well where it is stored. The USA produced 39% of natural gas through fracking in 2014. Many Americans support this as it lowered their fuel bills, created 2 million jobs and reduced the countries dependence on fuel from the Middle East. Compared to coal, gas is much cleaner. However, there are many environmental costs of fracking.

- The chemicals used to force the gas out of the rocks can leach into the local groundwater supplies impacting on the water quality. Some drinking wells located near fracking sites have 17X higher levels of methane in the water. This can damage the local ecosystems and make people who drink the water ill.
- There is a link between fracking and subsidence, as the rocks are disturbed beneath the ground. As well as this gas has been known to enter peoples water supplies making the drinking water flammable.
- Fracking leads to the loss of habitats.
- There can be an increase in local traffic as trucks carry building materials and gas.



CASE STUDY—Oil reserves at the Athabasca tar sands, Canada

This region has significant oil reserves in the form of tar sands. There is approximately 180 billion barrels of bitumen within the sand deposits that can be refined into petroleum. With dwindling oil supplies and the rising cost of oil and the development of new technology exploiting this area seemed worthwhile despite the costs. However, there are still concerns about the environmental damage.

1. Surface mining is needed to gain access to the tar sand deposits. This means deforestation occurs and a large area of land is cleared, leading to the loss of local habitats.
2. An estimated 6 barrels of water are needed for each barrel of oil produced. Therefore, large volumes of water are needed. The water is extracted from the Athabasca river, this threatens the local wildlife and locals water supplies.
3. This process releases 15% more CO_2 than refining crude oil.
4. There have been many leaks into local rivers and lakes (an estimated 11 million litres of toxic waste reaches the Athabasca river daily).

Exam Questions

1. Explain why urban transport schemes can contribute towards lowering carbon emissions (4)
2. What is the difference between a carbon footprint and an ecological footprint? (2)
3. Assess the benefits of developing energy-efficient homes and transport systems. (8)
4. Explain two benefits on the environment of developing renewable energy resources. (4)

Key Terms

Energy efficient
Energy conservation
Combined heat and power (CHP) generators
Congestion
Kinetic energy

Reducing Reliance on Fossil fuels presents major technical challenges

To reduce the demand for energy there are two options: energy efficiency and energy conservation. Energy efficiency is providing the same service but using less energy e.g. energy efficient light bulbs. Energy conservation is about not using as much energy e.g. switching TVs off when not in use. These are both important for reducing CO2.
Reducing the energy demand:

- Woking Borough Council are promoting the use of energy efficiency and conservation. They have encouraged homeowners to use sustainable strategies to reduce the amount of energy they use. By 2008, the council reduced its energy consumption by 52% and carbon dioxide emissions by 82% in comparison to 1990 levels.
- Woking council set up its own utility company Thameswey Energy, it is a non-profit company and is responsible for providing sustainable energy to the council and other organisations working in the area. They use CHP and photovoltaic (PV) solar farms to generate energy. The council also converted an old police house and used energy efficient and conservation technologies to educate locals on how to be more sustainable and lower their carbon footprint.

Energy efficient transport systems:

- Over 20% of worldwide energy consumption, from fossil fuels is due to transport. Sustainable transport methods use less energy and improves the quality of life for people in the city. Another method is to have congestion charging and cycling schemes so people are more likely to choose sustainable transport methods.
- Congestion from traffic is common in cities, this leads to longer journey times and a lower air quality. Since 2003, London has had a congestion charge to reduce congestion and pollution. Users have to pay to drive into central areas. This scheme cost £80 million to set up but generates approximately £252 million per annum in revenue, which has helped improve public transport. The scheme has reduced CO2 emissions by 19% and reduced fuel use by 20%. There has been a 45% increase in bus users and air quality has improved by 12%.
- Paris launched a city-wide cycling scheme in 2007, Velibs. This was to reduce traffic congestion. It is a self-service system which includes 23,500 bikes parked at 1400 stations around Paris, for €29 membership fee. The first 30 minutes on the bike is free, after that hourly rental increases. However, it is still much cheaper than buses, trains and cars. In the first 3 months' CO2 emissions fell by 32,330 tonnes, 100,000 people used the bikes and people travelled an estimated 300,000Km. By 2012, Parisians made 130 million trips on bikes and vehicle traffic decreased by 25%.

Type of alternative energy	Costs	Benefits
Wind Energy— Wind turbines generate electricity through kinetic energy.	• Locals state they spoil their view of the landscape. • Offshore windfarms are too far away so expensive transmission lines are needed. • Turbine blades cause 4 bird deaths per year on average.	• Clean energy—no pollution • Can generate hundreds of megawatts (MW) of electricity. • Cheapest renewable energy source for consumers.
Solar Energy— This technology uses PV cells to convert light into electricity. The cells do not require direct sunlight to work.	• Large solar farms can take up valuable agricultural land. • Making the solar panels can harm the environment as toxic chemicals are used like mercury, lead and cadmium. • Ecosystems can be damaged whilst solar farms are constructed.	• It is creating hundreds of jobs. • Requires little maintenance • No noise is created • Cheap • No pollution once they are up and running
Hydro-electric power— Water turbines use kinetic energy to generate electricity.	• Expensive to build and can spoil natural landscapes • Displace people and animals due to flooding • Changes in river flow which can impact wildlife and ecosystems.	• Reliable and consistent • Production can be altered to meet demands • Can help conserve water with dams and reservoirs
Biofuels— Biofuel crops are grown instead of food crops.	• Large amounts of water are needed. • Competition for land from food farmers. • Deforestation can increase where supplies can't meet the demand.	• Fewer carbon emissions are created • Cheaper than fossil fuels • You can reuse and recycle materials to make biofuels.
Hydrogen—Hydrogen is burnt to create a fuel source as opposed to petrol and diesel.	Energy is needed to release hydrogen gas from water, therefore fossil fuels could be needed. It is difficult to store hydrogen safely/	• Clean energy • Made from water • Efficient

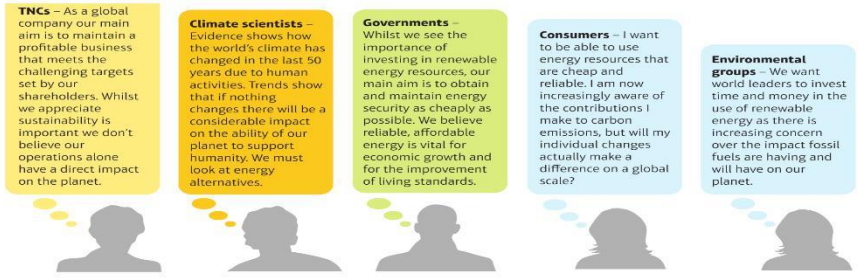


Figure 15 The different views about energy futures

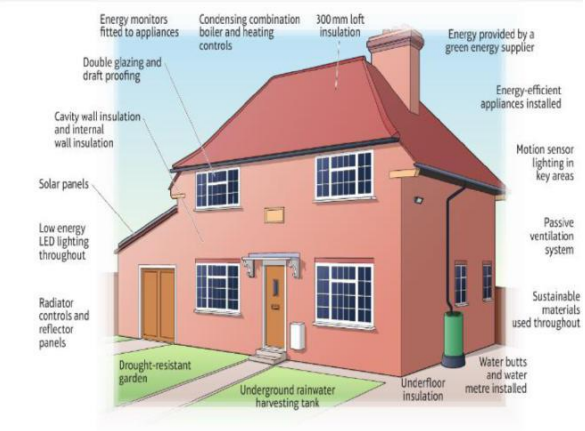


Figure 13 Oak Tree House, low-carbon home

Exam questions

1. Assess the reasons why opinions about the use of renewable energy vary (8)
2. Assess the following statement 'ordinary people hold the key to solving the energy issues of the world (8)
3. Explain why some homeowners are in favour of lowering their eco and carbon footprints, while others are against it (4)
4. Explain how organisations have a responsibility to lower their carbon and eco-footprints (6)
5. Explain how education is helping to change people's views about energy (4)

How do attitudes to the exploitation and consumption of energy vary?

Scientists predict that from 2013-2035 the global demand for energy will increase by 37% due to population increase and better living standards. If fossil fuels continue to dominate the global energy mix it will be catastrophic for climate change. Stakeholders have different views on what our 'energy future' holds. This ranges from business as usual to more sustainable approaches.

How are attitudes changing?

It was predicted in 2015 that by 2020 the use of non-renewable energy sources would decrease to 76%. This is due to a number of factors such as:

Increased affluence—people are supporting the investment of clean and sustainable energy as rising incomes generally means a rise in the demand for energy.

Environmental concerns— with more research and awareness of the impact fossil duels have on the environment, there has been a worldwide demand for a change to sustainable and clean energy.

Education—the UN, schools and governments have made people increasingly aware of the alternatives to fossil fuels and the importance of sustainable and clean energy which has changed people's views.

Key Terms

Affluence
Education
Carbon footprint
Ecological footprint

Some countries such as India, an emerging country have difficulty in becoming more sustainable. This is due to them needing cheap energy to improve standards of living and for economic growth.

An ecological footprint can show peoples impact on the planet in order to provide all the resources we use and how we dispose of our waste

Different attitudes:

Individuals— People can measure their carbon footprint which shows their impact on the environment. This raises peoples awareness of how much energy use and how much it is costing them economically and environmentally. This helps people make changes to reduce their carbon emissions. The carbon footprint shows people how to become energy efficient. Generally domestic heating is the biggest user of energy in houses (15%), and most of the energy used is lost due to poor insulation. Powering homes uses 12% of energy and again most of this energy is lost through appliances which are switched on, but are not used. Finally, private transport is the 3rd biggest user of energy for individuals (10%), individuals can reduce this by car sharing, taking the bus, walking or cycling.

Organisations— Large organisations such as Google and McDonalds have applied a sustainable approach to their business operations. However, as the price of fossil fuels is currently cheaper than renewable energy and the technology is already in place for fossil fuels, companies like McDonalds and Google still rely on them. NGO's like Greenpeace feel that changes need to be more significant and companies should take more responsibility for the environment, and become more sustainable.

Governments— The UK was one of 195 countries to attend the UN climate change summit in Paris. In 2015. They pledged to limit the global temperature rise to 2degrees Celsius. Individual countries set their own targets to reduce carbon emissions, and developed countries set up a £100 billion fund to help developing countries be more sustainable. The UKs targets are:

1. Set carbon budgets to limit the greenhouse gas emissions.
2. Invest in low carbon technology so that by 2050 the UK produces 80% less carbon than it did in 1990.
3. Reduce the demand for energy by implementing smart meters in homes and businesses.
4. Create a public report of carbon emissions to allow people to assess their impact on climate change

Geography GCSE
Paper 1: Global Geographical Issues
2/3 mark questions
Hazardous Earth

Explain why tropical cyclones lose their power over land. (2)
Explain one reason why low lying coast lines are vulnerable to tropical cyclones (2)
Explain one way people can predict volcanic eruptions or earthquakes (3)
Explain how tropical cyclones form (3)
Explain one reason why some tropical storms intensify into cyclones (2)
Compare the physical property of the core and the mantle. (3)
Explain how convection currents contribute to plate movements (3)
Explain two ways some earthquakes cause more damage and loss of lives than others (2)
Explain two secondary impacts often caused by volcanic eruptions (2)
Referring to named examples, state two ways people can protect themselves against earthquakes and volcanic eruptions (3)
For a named earthquake or volcanic eruption, explain the short term relief efforts (3)
Explain one short term relief measure that can help people during a volcanic eruption (2)
Explain how one type of evidence can help reconstruct past climates (3)
Explain one hazard brought by tropical cyclones (2)
Explain one reason why people in Bangladesh are especially vulnerable to flooding. (2)
Explain one difference between oceanic and continental crust (3)
Explain one role of ocean currents (2)
Explain one cause for the movement of tectonic plates. (3)

Development Dynamics

Explain one way in which the human development index (HDI) measures development (2)
Explain one reason why economic growth leads to higher levels of all types of pollution in emerging countries (3)
Explain one advantage of top down development strategies (2)
Explain one way in which outsourcing affects economic development in an emerging country (3)
Describe how Rostow's theory can be used to help understand economic growth over time. (3)
Describe how Frank's dependency theory can be used to help explain how countries develop. (2)
Explain some of the problems with development theories (3)
Suggest why Frank's dependency's theory may not apply to some countries today. (3)
State two characteristics of top down development. (2)
Explain one advantage of intermediate technology. (3)
Many TNC's have located their operations in emerging countries. Suggest how people in emerging countries can benefit from TNC's. (3)
Describe the location of the emerging country that you studied in your case study. (3)
Explain one feature of the political context of the emerging country you have studied. (3)
Describe how the natural environment and culture of your emerging country has influenced its economic development. (3)
Explain the impact of globalisation on the environment of emerging countries. (3)
Referring to a named developing or emerging country, describe how levels of development vary within a country. (2)
For a named emerging country, explain how global trade has contributed to the economic development of the country. (3)
Explain one way international organisations have affected the development of the economy of an emerging country you have studied. (3)
Explain one physical factor that can prevent development progress in a country. (3)

Challenges of an urbanising world

For the megacity named, explain the building age in the urban rural fringe. (2)
For a named megacity in a developing or emerging country, state one way that site and one way that situation are

significant in a national context. (2)
Explain one challenge of rapid population growth for people in mega cities (2)
For a named megacity in a developing or emerging country, give two reasons why residential areas have a contrasting quality of life. (2)
Explain one way in which bottom up projects can improve city housing. (2)
Explain one problem associated with a developing world megacity. (2)
Explain one reason why some cities in the developed world have experienced a decline in population. (2)
Explain one problem for people working in the informal economy. (3)
Compare the economic activities in developed countries with those in developing or emerging countries. (3)
You have studied a megacity in an emerging or developing country as a case study, describe your megacity's location. (3)
Explain one reason why the location of the megacity you have studied has been important for it's growth (2)
Referring to a megacity you have studied, describe the land use in and around the CBD (2)
Referring to a megacity you have studied, explain how it has changed as a result of recent growth.(3)
Referring to a megacity you have studied, explain one social problem facing people living there. (3)
Explain one reason why large numbers of people in megacities in developing and emerging countries work in the informal sectors. (3)
Explain one reason for the differences in living conditions in megacities (2)
For a named megacity in a developing or emerging country, compare the residential areas of different groups of people. (3)
Explain one reason why there are inequalities in how people are housed in megacities. (3)
Explain one advantage of a top down strategy used to make a megacity more sustainable. (2)
Explain one disadvantage of a bottom up strategy used to make a megacity more sustainable. (2)
Referring to a named example, explain how living conditions in squatter settlements can be improved. (3)

8 and 12 mark questions:

Hazardous Earth

'The causes of past climate change and current global warming are different'. Assess this statement (8)
Using named countries, evaluate whether the impact of tectonic hazards on emerging or developing countries are greater than those in developed countries. (8)
Referring to a named example, evaluate the effectiveness of methods used to prepare for and respond to future tropical storms. (8)
Assess the importance of volcanic eruptions and changes to solar outputs to climate change. (8)
'Most global warming is caused by carbon dioxide emissions from a few rich developed countries'. Assess this statement. (8)
Assess the social and economic impacts of tropical cyclones on developing countries. (8)
Assess success of different methods of cyclone prediction and warning systems in a named developing country. (8)
Assess the success of different methods of cyclone prediction and warning systems in a named developed country.(8)
Assess the impact of volcanic eruptions on both developed and developing countries. (8)
Assess the primary and secondary impact of earthquakes on both developed and developing countries. (8)

Development Dynamics

For a named emerging country, assess how far economic growth has had a positive impact on its population. (8)
For a named emerging country, assess how far its development has been influenced by its location.(8)
For a named emerging country, assess to what extent globalisation has had a positive impact on the quality of life for the people living there.(8)
For a named developing country, assess how far patterns of trade have affected its economic development. (8)
For a named developing country, assess how far it has benefitted from globalisation. (8)

Assess the social and economic impact of TNC's on emerging countries. (8)
Using examples assess the changes brought by globalisation to one emerging country.(8)
For a named top down development project, evaluate its benefits and problems. (8)
For one emerging country, evaluate the impact of its international relations with other countries.

Challenges of an urbanising world

Assess whether economic development always leads to economic growth. (8)
For a named megacity assess how far rapid population growth has affected attempts to make it more sustainable. (8)
For a named megacity evaluate the attempts made to improve the quality of life for people living there. (8)
For an emerging country you have studied, assess the social and economic impact of government policy. (8)
Using examples assess the effects of suburbanisation upon cities. (8)
For a named megacity, assess the social and environment impact of its rapid population growth.(8)
For a named megacity, assess the reasons for variations in the quality of life for its people. (8)
For a named megacity, assess the success of a top down development project designed to improve quality of life. (8)
For a named megacity, assess the success of a bottom up development project designed to improve the lives of ordinary people. (8)

Paper 2: UK Geographical Issues

2/3 mark questions

The UK's Evolving Physical Landscape

Explain one way glaciation has affected the physical landscape of the UK (2)
Explain why groynes can reduce coastal erosion (2)
Explain one reason why the antecedent conditions in a drainage basin can affect the peak discharge of a river's hydrograph (2)
Explain one way weathering affects slopes (2)
Explain two possible reasons why erosion is rapid on a coastline. (2)
Describe how river discharge is calculated. (2)
Explain one way glacial processes have contributed to the formation of the UK's physical landscape (2)
Explain one way past tectonic processes have caused the development of the Grampian mountains in Scotland (2)
State the main characteristic of sedimentary rock (2)
Slate is an example of metamorphic rock. Explain how metamorphic rocks form. (2)
State two differences between discordant and metamorphic coasts (2)
Describe two characteristics of soft rock cliffs (2)
Explain two differences between the destructive and constructive waves (2)
Describe one way in which wave action can erode coastal cliffs (3)
State two factors that influence the size and the type of the wave(3)
Define the term "sub-ariel processes" (2)
Explain one reason why coasts retreat at different rates (3)
For a named example, explain one process that has changed the coastal landscape (3)
For a named example, explain how coastal management processes have changed the coastal landscape. (3)
Explain how groynes can help reduce rates of coastal erosion (2)
Describe one disadvantage of beach nourishment (2)
Explain one advantage of using hard defences at the coast. (2)
Explain one way the Integrated Coastal Zone Management (ICZM) techniques can be used to protect the coastline (2)
Define the term "Long Profile" (2)
Explain the process of abrasion (2)
Explain how a meander is formed (3)
Describe the relationship between river depth and velocity on a meander (2)
Describe the process that forms levees (2)
Explain how deltas form (3)

Explain one way climate affects river landscapes and sediment load (3)
Explain one reason river flooding is likely to become more frequent in some parts of the UK (2)
Explain how flood defences work (2)
Explain why planting trees in a river catchment helps reduce flooding (3)
Explain one way past tectonic processes influenced the physical landscape of the UK (2)
Explain one way rock type influences the relief of the land in the UK (2).
Explain one way in which human activity has influenced the UK's physical landscape (2).

The UK's Evolving Human Landscape

State two reasons why tertiary employment has increased in the UK. (2)
Explain one reason why some regions of the UK have experienced almost no population growth in the past 50 years (2)
Explain one reason why major cities attract large numbers of international migrants (2)
State two characteristics of a Central Business District (CBD) (2)
State two reasons why foreign direct investment (FDI) has increased in the UK (2)
Explain one reason why secondary employment has declined in the UK (2)
Explain one reason why child poverty varies in urban areas. (2)
Suggest two reasons why younger people move to urban areas (2)
Explain one way the government policy can reduce the regional differences within the UK. (2)
Describe how international migration may affect ethnic and cultural diversity in the UK (2)
Suggest reasons for the decline in the number of coal miners in the UK (3)
Describe the benefits of FDI for the UK (2)
Explain why FDI has increased in the UK in recent years (3)
With reference to a named city in the UK, explain one way its location has been important to its growth and development. (3)
With reference to a named UK city, explain one impact of heavy industry on the environment. (3)
For a named UK city, explain one cause of migration into the city (2)
With reference to a named UK city you have studied, explain why economic decline has occurred. (3)
State two ways cities depend on nearby rural areas (2)
Explain one environmental cost of the inter-relationship between cities and rural areas. (2)
Explain one reason why farmers in the UK have diversified their activities (2)
State two characteristics of the quaternary sector employment (2)
State two characteristics of the inner suburbs (2)

Investigating Rivers/ Investigating Urban Areas

Describe one piece of primary data that could be collected that could help with your enquiry question (2)
Describe how the cross sectional area of the river is calculated (2)
Explain one way you used GIS in your own river processes and pressure investigation (2)
Explain how you selected the sites you used in your urban environment investigation (2)
Explain one weakness of the technique you used to investigate environmental quality. (2)
Explain one reason why the method you used to measure the velocity of the river was appropriate to the task (2)
Explain one possible source of error when you measured the depth of the river channel (2).
You have used the Environment Agency flood-risk map in your investigation. Explain one way the Environment Agency flood-risk map supported your investigation. (2)
Explain one disadvantage of using the 2010 Index of Multiple Deprivation as a source of secondary data to investigate urban quality of life (2)
Explain one weakness of using a choropleth map to show urban deprivation (2)
Explain one weakness in the method you used to collect qualitative data (2)
Explain one way you attempted to make your data collection reliable. (2)
Explain one advantage of using a line graph to show the long profile of a river (2 mark)
Explain one technique that you used to present your river sediment data (2).
Explain one factor about your primary data which could have affected your results (2).
Explain one advantage of using a line graph to show the changes in environmental quality along a transect line in an

urban area (2).
Explain one technique that you used to present your IMD data (2)

The UK's Physical Environment

Assess the factors which affect the pattern of UK properties at risk from flooding.(8)
Assess the costs and benefits of future increases in spending on flood defences in the UK.(8)
Assess the risks from erosion of future sea level rise to people and their property.(8)
Assess the costs and benefits of hard and soft engineering to manage erosion risks in the UK.(8)
Assess the value of hydrographs in helping to evaluate flood risks to people and their properties. (8)
Evaluate the role of physical and human processes in causing flooding.(8)
Explain how physical processes work together in the formation of a spit.(8)

The UK's Human Landscape

Assess the causes of variations in house price affordability in the UK.(8)
Assess the causes of variations in average weekly earnings in the UK.(8)
Assess the variations in ethnic group distribution for a named city in the UK you have studied.(8)
Assess the causes of differences in life expectancy for a named city in the UK you have studied.(8)
Assess the reasons for re-urbanisation that are taking place in a major UK city.(8)
Assess the impacts of the cost of living on different groups of people for a named city in the UK.(8)
Evaluate the success of strategies aimed at making urban living more sustainable.(8)

Investigating River Processes and Pressures/ Investigating Dynamic Urban Areas

Using the conclusions from your Geographical Investigation, assess the accuracy and reliability of your results. (8)
Evaluate the relative importance of primary and secondary data in your investigation(8)
Evaluate the reliability of your river fieldwork conclusions.(8)
Evaluate the reliability of your urban fieldwork conclusions.(8)
Evaluate the different techniques used to analyse your fieldwork data.(8)

Practice questions (Unit 3)

People and the Biosphere

1. Describe the climatic features of the tropical rainforest. (2)
2. Outline the characteristics of the tropical rainforest. (3)
3. Outline the climatic features of a temperate forest. (2)
4. Outline the characteristics of the temperate forest. (3)
5. Outline the climatic features of a boreal forest. (2)
6. Outline the characteristics of the boreal forest. (3)
7. Outline the climatic features of a savannah grassland. (2)
8. Outline the characteristics of the savannah grassland. (3)
9. Outline the climatic features of a deserts. (2)
10. Outline the characteristics of the deserts. (3)
11. Outline the climatic features of tundra. (2)
12. Outline the characteristics of the tundra. (3)
13. Explain how biome distribution can be affected by local factors. (4)
14. Outline how the biosphere provides goods and services for humans. (4)
15. Explain how the biosphere helps to regulate the earth's atmosphere. (3)
16. Explain how the biosphere helps to keep soil healthy. (3)
17. Explain how the biosphere helps to regulate the water cycle. (3)
18. Explain the factors that are leading to an increased global demand for resources. (4)
19. Outline Malthus's theory of resource supply and demand. (2)
20. Outline Boserup's theory of resource supply and demand. (2)

Forests under threat

21. Explain how plants have adapted in the tropical rainforest. (4)
22. Outline how ecosystems in the tropical rainforest and interdependent. (4)
23. Explain how animals have adapted to survive in the tropical rainforest. (4)
24. Outline how nutrients are recycled quickly in the tropical rainforest. (3)
25. Outline the threats to tropical rainforests. (4)
26. Explain how deforestation of tropical rainforests can cause global environmental impacts. (4)
27. Outline how climate change is an indirect threat to the tropical rainforest. (3)
28. Explain why rates of tropical rainforest deforestation varies from country to country. (4)
29. Outline the advantages and disadvantages of a global action taken to protect the tropical rainforest. (4)
30. Outline the social factors which make sustainable tropical rainforest management a challenge. (3)
31. Outline the economic factors which make sustainable tropical rainforest management a challenge. (3)
32. Outline the environmental factors which make sustainable tropical rainforest management a challenge. (3)
33. Explain how ecotourism might be a long term solution for sustainably manging the rainforest. (4)
34. Outline how sustainable farming might prevent rainforest deforestation. (4)
35. Explain how plants have adapted to survive in the climate of the Taiga ecosystem. (4)
36. Explain how animals have adapted to survive in the climate of the Taiga ecosystem. (4)
37. Explain why nutrient recycling in the Taiga is a slow process. (4)
38. Outline the threats to the Taiga forest ecosystem. (4)
39. Explain how climate change is an indirect threat to the Taiga forest. (3)
40. Outline why many people believe that Taiga forests should be protected from further exploitation. (4)
41. Outline why many people believe that Taiga forests should be exploited for their resources. (4)
42. Outline one method of protecting the Taiga forest ecosystem.

Consuming energy resources

43. Define the term 'renewable energy'. (2)
44. Define the term 'non-renewable energy'. (2)
45. Define the term 'recyclable energy'. (2)
46. Describe how the extraction of fossil fuels has a negative impact on the environment. (3)
47. Describe the environmental impacts of using renewable energy resources. (3)
48. Explain how a country's climate can affect their access to energy resources. (2)
49. Explain how a country's geology can affect their access to energy resources. (2)
50. Explain how a country's landscape can affect their access to energy resources. (2)
51. Explain how a country's level of development can affect their access to energy resources. (2)
52. Explain why energy consumption varies around the world. (4)
53. Explain why demand for oil is rising in emerging countries. (3)
54. Explain why demand for oil is falling in developed countries. (3)
55. Outline the factors that can affect the global price of oil. (4)
56. Explain how conflicts can cause the global oil price to rise. (2)
57. Outline how oil companies are taking ever greater risks to access oil. (4)
58. Outline the environmental impacts of exploiting unconventional fossil fuel supplies. (4)
59. Outline the social impacts of exploiting unconventional fossil fuel supplies. (4)
60. Outline how homes can be adapted to increase their energy efficiency. (4)
61. Outline how some countries have improved their energy efficiency through public transport policies. (4)
62. Outline the advantages of reducing our dependency on fossil fuels. (4)
63. Outline the costs and benefits of wind energy. (4)
64. Outline the costs and benefits of solar energy. (4)
65. Outline the costs and benefits of HEP. (4)
66. Outline the costs and benefits of hydrogen fuel. (4)
67. Explain why people are now more aware of the need to reduce their energy consumption. (4)