L-Università ta' Malta

MATSEC
Examinations Board

Marking Scheme

AM Geography

First Session 2019

A. Paper 1

Answer **FOUR** questions in total. Questions carry equal marks.

1. Figure 1 shows the actual value of precipitation in the UK over eight days in November 2012.

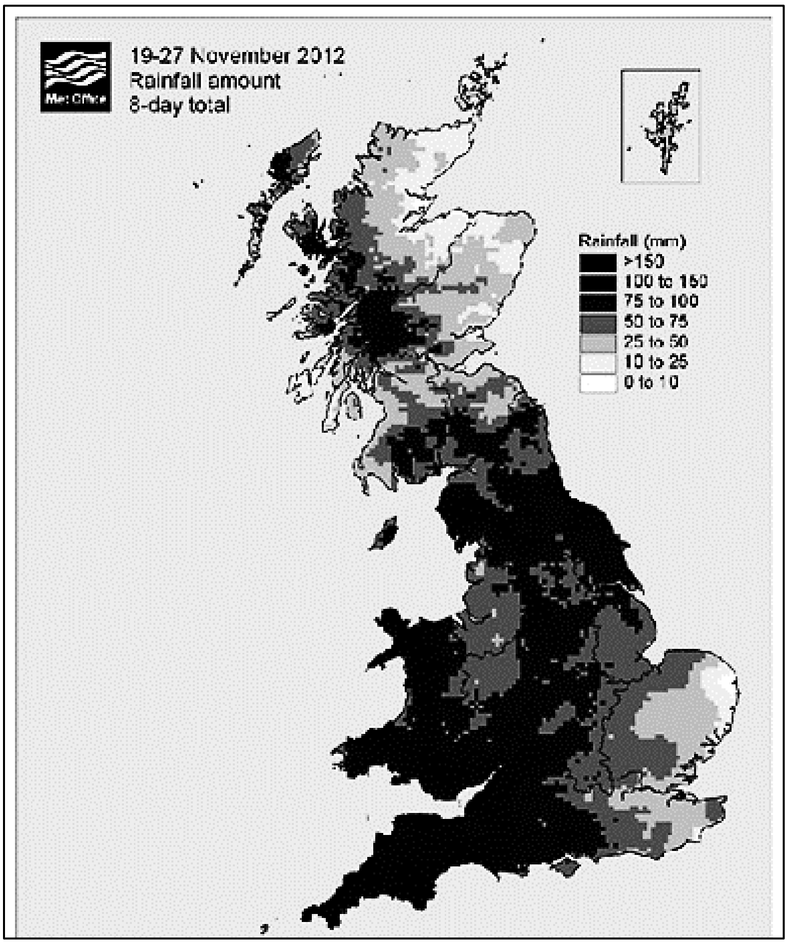


Figure 1: Actual value of precipitation in the UK over eight days in November 2012.
(*adapted from*: https://metofficenews.files.wordpress.com/)

(a) Outline the key findings of Figure 1. (4 marks)

[There is no need for students to quote the exact amount of rainfall. It is important that students make reference to the zones (e.g. north-west zone) that have the highest/least amount of rainfall]

Figure 1 shows that the lowest rainfall total between the 19th and 27th November 2012 was for South-East England (with approximately less than 50 mm of rain) and for North-East England (with also less than 50 mm of rain or less). Overall, in the South-Eastern part of the UK, the closest the distance to the coastline the lower was the rainfall. The South-Western part of the UK received the highest amount of rainfall, exceeding the 75 mm. Such high values of precipitation were also recorded in concentrated areas in the North-Western part of the UK. This means that overall, the western part of the UK received more rainfall than the eastern part.

(b) With reference to your answer in question (a), discuss the main factors that cause some places to get more precipitation than others in the UK. (4 marks)

The map shows a divide between the west (and south-west) and the south-east of the UK. The prevailing warm moist westerly winds mean that the west of the UK is more likely to receive rainfall from Atlantic weather systems - in the form of frontal rainfall. These weather systems usually move from west to east across the UK and as they do so the amount of rainfall they deposit reduces. This is because the mountains of the northern and western UK force the prevailing westerly winds to rise, which cools the air and consequently enhances the formation of cloud and rain in these locations (orographic enhancement).

(c) Choose **ONE** type of high clouds and **ONE** type of low clouds and explain their key characteristics **and** precipitation associated with them. (4 marks)

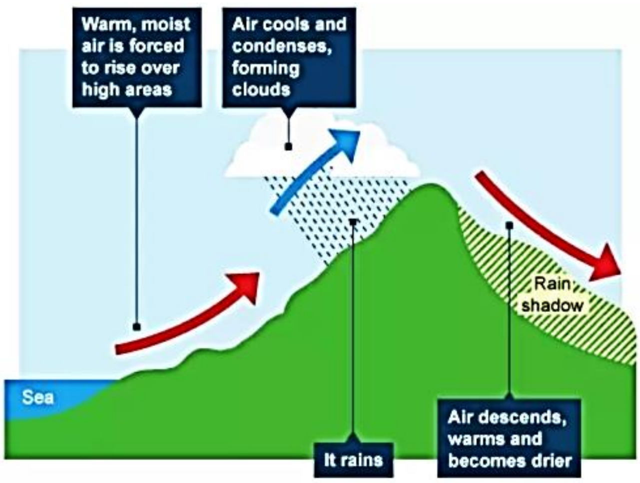
High clouds:

- Cirrus – Detached, wispy, delicate white clouds. May have feathery filaments known as "mares' tails" indicating strong upper-atmosphere winds. No precipitation.
- Cumulo-nimbus – An extreme vertical extension of cumulus. It may develop an anvil at is head (ice crystals) and may become black at its base. Heavy showers; thunderstorms; hail.
- Cirrocumulus – Thin layers of small, globular masses with a rippled appearance (also known as mackerel sky). No precipitation.
- Cirrostratus – A thin milky layer appearing like a veil. The sun or moon may shine through it with a halo effect. No precipitation.

Low Clouds:

- Stratus – A persistent, grey, uniform sheet of cloud. Made of water droplets and associated with drizzle.
- Nimbostratus – A thick, dark grey-black cloud, usually uniform but may have detached, darker patches beneath it. Continuous rain/snow.
- Stratocumulus – A grey-white, patchy cloud appearing in long rows or in rolls. Occasional showers.

(d) Explain the key characteristics of orographic rainfall. Include a diagram to illustrate your answer. (5 marks)



Orographic rainfall results when near-saturated, warm maritime air is forced to rise where confronted by a coastal mountain barrier. Mountains reduce the water-holding capacity of rising air by enforced cooling and can increase the amounts of cyclonic rainfall by retarding the speed of depression movements. Mountains also tend to cause air streams to converge and funnel through valleys. Rainfall totals increase where mountains are parallel to the coast and where winds have crossed warm offshore ocean currents. As air descends on the leeward side of a mountain range, it becomes compressed and warmed and condensations ceases, creating a rain shadow effect where little rain falls.

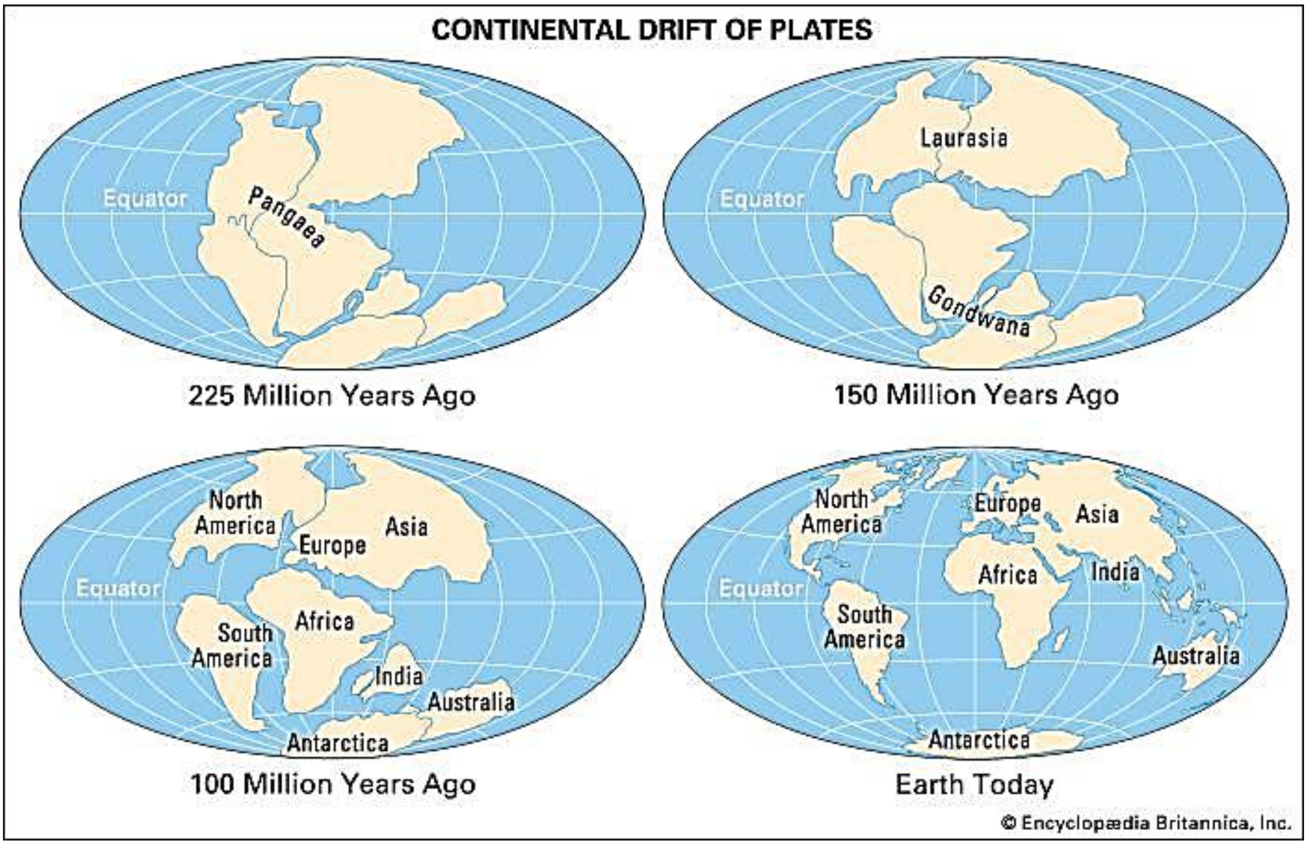
(e) Discuss how global warming is affecting global patterns of precipitation. (8 marks)

A warmer atmosphere can hold more moisture, and globally water vapour will increase due to the warming of temperatures. Hence, the total volume of precipitation is likely to increase. Regions that are already wet are likely to get wetter. The dry regions of the subtropics are likely to get drier and will shift towards the poles. For much of Europe, wetter winters are expected, but with drier summers over central and Southern Europe. In a warmer climate heavy rainfall will increase and be produced by fewer more intense events. This could lead to longer dry spells and a higher risk of flooding.

2. Earth was once a supercontinent, called 'Pangaea', but with time continents have drifted apart to form the present day configuration.

(a) Explain the 'Theory of Continental Drift'. Include a diagram to illustrate your answer. (10 marks)

Continental drift was a theory that explained how continents shift position on Earth's surface. Set forth in 1912 by Alfred Wegener, a geophysicist and meteorologist, continental drift also explained why look-alike animal and plant fossils, and similar rock formations, are found on different continents. Wegener thought all the continents were once joined together before breaking up and drifting to their current positions. But geologists soundly denounced Wegener's theory of continental drift after he published the details in a 1915 book called "The Origin of Continents and Oceans." Part of the opposition was because Wegener didn't have a good model to explain how the continents moved apart.



(b) Describe in detail **THREE** types of evidence that support the 'Theory of Continental Drift'. (15 marks)

1. **Fossils**

Biological Fossils: Fossils of the ancient reptile mesosaurus are only found in southern Africa and South America. Mesosaurus, a freshwater reptile only one meter (3.3 feet) long, could not have swum the Atlantic Ocean. The presence of mesosaurus suggests a single habitat with many lakes and rivers.

Plant Fossils: Wegener studied plant fossils from the Arctic archipelago of Svalbard, Norway. These plants were not the hardy specimens adapted to survive in the Arctic climate. These fossils were of tropical plants, which are adapted to a much warmer, more humid environment. The presence of these fossils suggests Svalbard once had a tropical climate.

2. **Stratigraphy/Geology** (fitting pieces of the jigsaw puzzle):

Wegener studied the stratigraphy of different rocks and mountain ranges. The east coast of South America and the west coast of Africa seem to fit together like pieces of a jigsaw puzzle, and Wegener discovered their rock layers "fit" just as clearly. South America and Africa were not the only continents with similar geology. Wegener discovered that the Appalachian Mountains of the eastern United States, for instance, were geologically related to the Caledonian Mountains of Scotland.

3. **Climatology**:

Coal formed under warm wet conditions, is found beneath the Antarctic ice cap, and evidence of glaciation had been noted in tropical Brazil and central India. Coal, sandstone and limestone could not have formed in Britain with its present climate.

3. Coastal erosion is often defined as the loss of coastal lands due to the net removal of sediments or bedrock from the shoreline (United Nations Office for Disaster Risk Reduction, 2017).

(a) Explain **THREE** processes of coastal erosion. (6 marks)

- **Wave pounding** – Steep waves have considerable energy. When they break as they hit the foot of cliffs or sea walls, they may generate shock-waves of up to 30 tonnes per metre squared.

- **Hydraulic pressure** – When a parcel of air is trapped and compressed, either in a joint in a cliff or between a breaking wave and a cliff, then the resultant increase in pressure may, over a period of time, weaken and break off pieces of rock or damage sea defences.

- **Abrasion** / **Corrosion** – This is the wearing away of the cliffs by sand, shingle and boulders hurled against them by the waves. It is the most effective method of erosion and is most rapid on coasts exposed to storm waves.

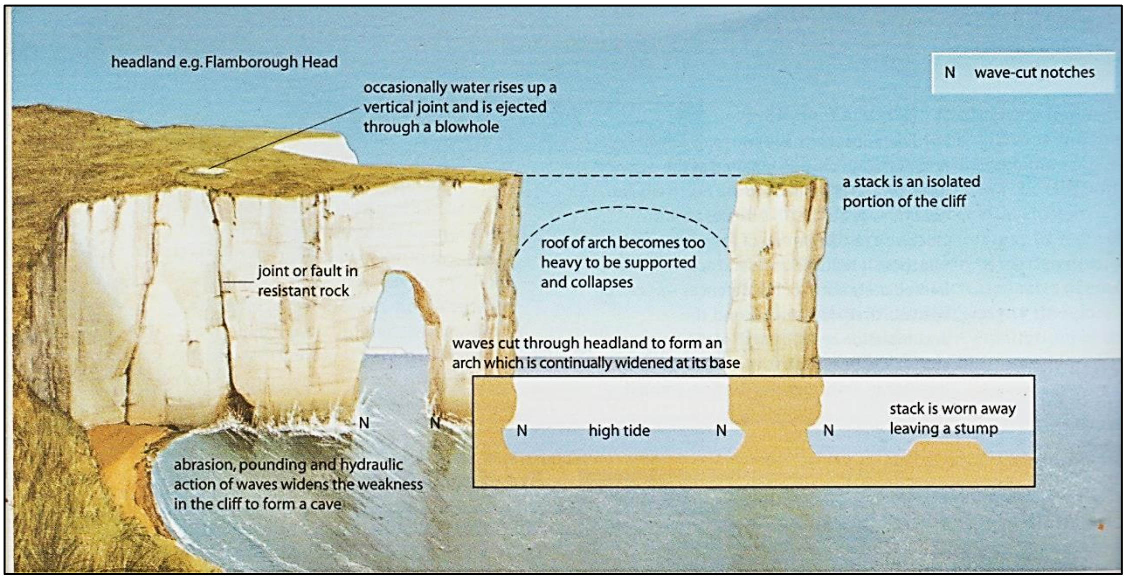
- **Attrition** – Rocks and boulders already eroded from cliffs are broken down into smaller and more rounded particles.

- **Corrosion** / **Solution** – This includes the dissolving of limestones by carbonic acid in sea water, and the evaporation of salts to produce crystals which expand as they form and cause the rock to disintegrate. Salt from sea water or spray is capable of corroding several rock types.

- **Subaerial** – Mass failure may be caused by such non-marine processes as rain falling directly onto the cliff face; by throughflow or, under extreme conditions, surface runoff of water from the land; and the effects of weathering by the wind and frost. These processes, individually or in combination, can cause mass movement either as soil creep on gentle slops or as slumping and landslides on steeper cliffs.

(b) Using a diagram/diagrams to support your answer, explain the role of erosion in the formation of caves, blowholes, arches and stacks. (11 marks)

When cliffs are made up of resistant rock, wave action attacks any line of weakness such as a joint or a fault. Sometimes the sea cuts inland, along a joint to form a narrow, steep-sided inlet called a geo, or at other times, it can undercut part of the cliff to form a cave. Caves are often enlarged by several combined processes of marine erosion. Erosion may be vertical, to form blowholes, but is more typically backwards through a headland to form arches and stacks. The arch is continually widened at its base because of wave action. Stacks are an isolated pinnacle of rock standing some distance from the cliff coastlines. This results when the roof of the arch becomes too heavy to support and collapses.



(c) Discuss **FOUR** ways how coasts and/or cliffs can be protected from erosion. (8 marks)

Hard structural solutions:

- **Groynes** - A coastal structure constructed perpendicular to the coastline from the shore into the sea to trap longshore sediment transport or control longshore currents. This is usually constructed from a variety of materials such as wood, rock or bamboo and is normally used on sandy coasts.
- **Seawalls** – A structure constructed parallel to the coastline that shelters the shore from wave action. This structure can be used to protect a cliff from wave attack and improve slope stability and it can also dissipate wave energy on sandy coasts.
- **Offshore breakwater** - A structure that parallels the shore and acts as a wave absorber. It reduces wave energy in its lee and creates a salient or tombolo behind the structure that influences longshore transport of sediment. These structures are appropriate for all coastlines.
- **Artificial headland** - This structure is constructed to promote natural beaches because it acts as an artificial headland.

Soft structural solutions:

- **Beach nourishment** - The aim of beach nourishment is to create a wider beach by artificially increasing the quantity of sediment on a beach experiencing sediment loss, improving the amenity and recreational value of the coast and replicating the way that natural beaches dissipate wave energy. This method is often used in conjunction with hard structural/engineering options.

- **Dune building/reconstruction** - Sand dunes represent a store of sand above the landward limits of normal high tides where their vegetation is not dependent on the inundation of seawater for stability They provide an ideal coastal defence system.

- **Coastal re-vegetation** - The presence of vegetation in coastal areas improves slope stability, consolidates sediment and reduces wave energy moving onshore; therefore, it protects the shoreline from erosion. However, its site-specificity means that it may be successful in estuarine conditions (low energy environment), but not on the open coast (high energy environment). The type of vegetation depends on the type and structure of the coast/cliffs.

4. Figure 2 shows the Amazon River; it is the world's largest river by volume and contains 20% of earth's fresh water (Malewar, 2017).

Figure 2: The Amazon River (Malewar, 2017)

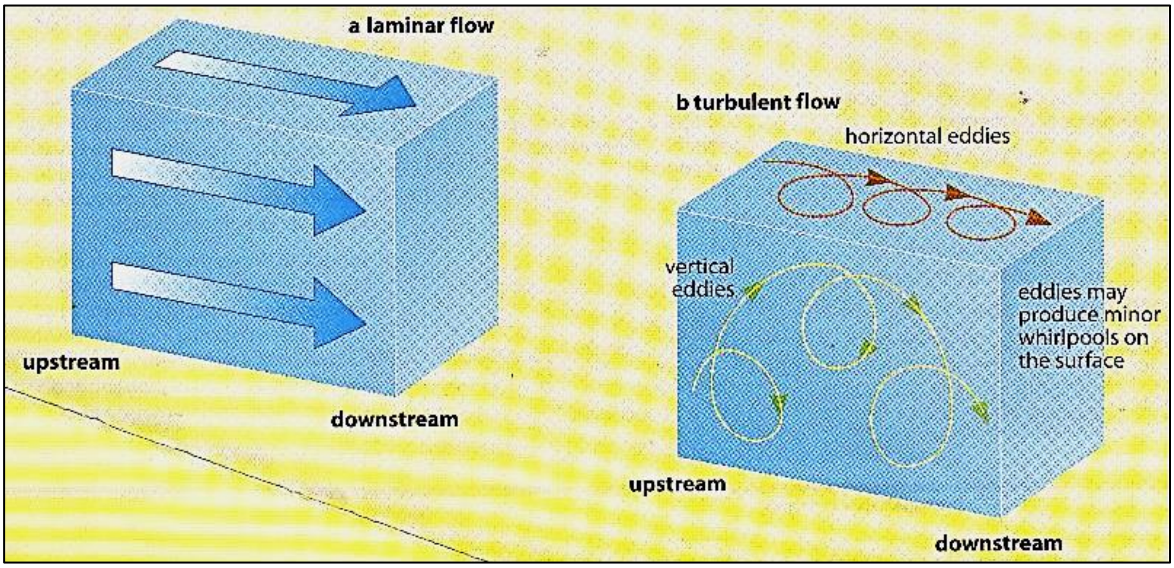
(a) With the help of a labelled diagram, explain the **TWO** patterns of flow in a river. (10 marks)

[2 marks each for the labelled diagram + 3 marks each for the explanation = 10 marks]

Laminar flow: a horizontal movement of water so rarely experienced in rivers that it is usually discounted. Such a method of flow, if it existed, would travel over sediment on the river bed without disturbing it.

Turbulent flow: is the dominant method, consists of a series of erratic eddies, both vertical and horizontal, in a downstream direction. Turbulence varies with the velocity of the river which, in turn depends upon the amount of energy available after friction has been overcome.

Example of labelled diagram:



(b) Describe **THREE** factors that influence the velocity of a river. (15 marks)

[5 marks for each factor discussed]

Channel shape – also known as hydraulic radius – is the ratio between the area of the cross-section of a river channel and the length of its wetted perimeter. The cross-section area is obtained by measuring the width and the mean depth of the channel. The wetted perimeter is the total length of the bed and bank sides in contact with the water in the channel.

Roughness of the channel's bed and banks – a river flowing between banks composed of coarse material with numerous protrusions and over a bed of large, angular rocks meets with more resistance than a river with cohesive clays and silts forming its bed and banks. As bank and bed roughness increase, so does turbulence.

Channel slope – As more tributaries and water from surface runoff, throughflow and groundwater flow join the main river, the discharge, the channel cross-section area and the hydraulic radius will all increase. At the same time, less energy will be lost through friction and the role of bedload material will decrease. As a result, the river flows over a gradually decreasing gradient – the characteristic concave long profile (thalweg).

5. Malta's economic growth is projected to remain robust until 2020 (European Economic Forecast, 2018). Worldwide, the recurring questions revolve around the imbalance between the economy, the environment, and society – the economy is failing the environment, and humanity (World Economic Forum, 2019). This failing situation is also visible in Malta with the degradation of habitats and loss of biodiversity (MEPA, 2014).

(a) Discuss how both a robust economy and a healthy environment, that includes thriving habitats and healthy biodiversity, are important for Malta. (13 marks)

Indicative answer: Candidates should ideally show that they know about the current boost of the economy in Malta that is associated with the quaternary industry – namely IT - through gaming and Fintech and others e.g. pharmaceuticals. The tourism sector keeps consistent in its importance. This thriving economy has led to a population increase, mainly as a result of foreign workers residing in Malta. This situation led to a boom in the building industry, with the property market climbing highest in the world alongside Hong Kong. Candidates should argue that while this situation is economically beneficial, this is to the detriment of the natural environment. They are expected to mention the issue of limited land area in Malta and threats to the limited habitats and biodiversity, with major threats to indigenous and endemic species. Such issues will have lasting repercussions and will contribute to environmental degradation. Thriving habitats and a healthy biodiversity are important for a better quality of life for the residents of the island and to attract tourism. Candidates should argue that striking the right balance is important and we need to protect the environment, because in the end a degraded environment will lead to a recursive cycle and result in a declining economy.

(b) Explain **THREE** policy initiatives that can help reduce the degradation of habitats and loss of biodiversity in Malta. (12 marks)

Indicative answer:
Answers can be elaborated on any three of the following. The answers are not restricted to the following:

1. **Marine Protected areas** – protected areas of seas, oceans, estuaries or large lakes. These marine areas can come in many forms ranging from wildlife refuges to research facilities.

2. **Natura 2000 sites** – a network of nature protection areas in the territory of the EU that is made up of SACs, and Special Protection Areas designated respectively under the Habitats Directive and Birds Directive.

3. **Special Areas of Conservation** – sites of national importance that should not be impacted by development.

4. **Habitats Directive** (Flora and Fauna) – ensures the conservation of a wide range of rare, threatened or endemic animal and plant species.

5. **Marine Strategy Framework Directive (MSFD)** – to protect more effectively the marine environment across Europe.

6. **Apply biodiversity strategies** (not only in writing but also in practice) e.g. the Water Framework Directive, together with conservation strategies.

7. **Establish ecological networks** with increased better places for nature for the benefit of flora, fauna, and people.

8. **Apply and enforce rules** associated with restricted development. Avoid building in ODZ (outside development zones) and use brown field sites. Avoid land exploitation.

9. **Raise public awareness**, integrate biodiversity values, improve incentives and sustainable production and use

10. **Enforce against introduction of invasive species**, include protected areas and conserve indigenous and endemic species

11. Enhance the benefits to all from biodiversity and ecosystems

12. Include public participation, improve knowledge, and use appropriate technologies

6. Figure 3 is a map showing the aggregated potential impact of climate change in Europe. The impacts are a weighted combination of physical, environmental, social and cultural potential impacts of climate change.

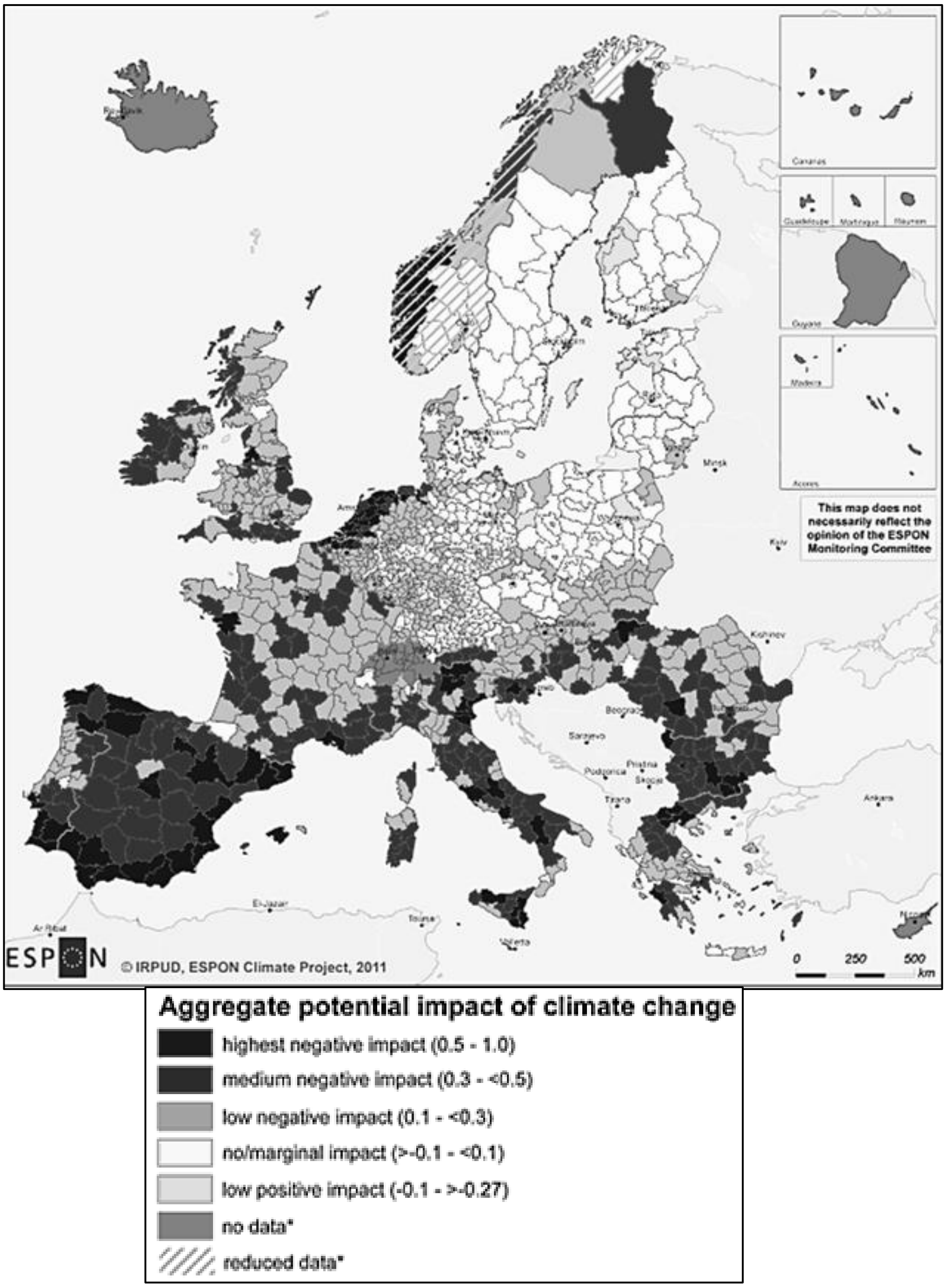


Figure 3: Aggregated potential impact of climate change (https://www.espon.eu/sites/)

(a) Outline the key findings of Figure 3. (4 marks)

[There is no need for students to give the exact numbers for the aggregated potential impact of climate change. It is important that students make reference to the zones with the highest or lower potential impact e.g. the coastal zones for the highest potential impact]

The potential impacts of climate change vary considerably across Europe. The most negatively affected regions are primarily found in the South of Europe – e.g. the big agglomerations and the summer tourist resorts along the coasts (e.g. most of the coast in Italy). Coastal regions are indeed those with the highest potential impact of climate change. One key reason for this is the sea-level rise resulting from climate change. Many mountain areas and coasts in other parts of Europe are also highly impacted (e.g. south-east of France, south-east of Sicily), even due to other reasons such as coastal storm surges, economic dependency on winter and/or summer tourism. Nevertheless, Spain (particularly its coastal areas) is the main country in Europe with the highest potential impact of climate change. Many central, eastern and northern European regions face virtually no or minimal negative potential impacts of climate change. Thus, the map shows a South-North imbalance.

(b) Discuss **TWO** important human factors contributing to climate change. (5 marks)

- **Burning coal, oil and gas (fossil fuel) produces carbon dioxide and nitrous oxide.**
- **Deforestation - Trees help to regulate the climate by absorbing CO_2 from the atmosphere. So when they are cut down, that beneficial effect is lost and the carbon stored in the trees is released into the atmosphere, adding to the greenhouse effect.**
- **Increasing livestock farming - Cows and sheep produce large amounts of methane when they digest their food.**
- **Fertilisers containing nitrogen produce nitrous oxide emissions.**

(c) Discuss **FOUR** ways how climate change is affecting coastal environments. (8 marks)

- **Rise in sea level** - water is increasingly invading coastal areas, causing soil erosion and threatening farmland, housing or recreation areas. The flooding of wetlands and pollution of aquifers also occur, affecting the flora and fauna. Low-lying islands can be swallowed by the oceans, leading to the disappearance of large land areas.
- **Impacts of changes in storm surge and precipitation** - Coastal areas are also vulnerable to increases in the intensity of storm surge and heavy precipitation. Storm surges flood low-lying areas, damage property, destroy habitat, and threaten human health and safety. Climate change is likely to bring heavier rainfall to some coastal areas, which would also increase runoff. Warmer temperatures in mountain areas could also lead to more spring runoff due to melting of snow. Consequently, increases in spring runoff may also threaten the health and quality of coastal waters. Decreases in precipitation could also increase the salinity of coastal waters.
- **Impact of increase in coastal water temperature** - coastal waters are warming up and this may lead to big changes in coastal ecosystems, affecting species that inhabit these areas. This also leads to the shifting of habitats with several southern species moving northward.
- **Impacts of acidity on coral reefs and shellfish** - Higher sea surface temperatures increase the risks of coral bleaching, which can lead to coral death and the loss of critical habitat for other species. A more acidic ocean adversely affects the health of many marine species, including plankton, molluscs, and other shellfish. In particular, corals can be very sensitive to rising acidity, as it is

difficult for them to create and maintain the skeletal structures needed for their support and protection.

(d) Describe **FOUR** adaptation practices that could minimise the impacts of climate change on coastal environments. (8 marks)

- **Coastal wetland protection and restoration** – This acts as buffer against extreme weather events, storm surge, erosion and floods. It also limits salt water intrusion.

- **Flood hazard mapping** – This informs coastal planning processes and policy. Hence, it reduces the impact of flooding resulting from storm events, heavy rain and storm surges.

- **Marine protected areas** – These maintain healthy and resilient coastal habitats and fisheries productivity; act as "refugia" and critical sources of new larval recruits.

- **Coastal development setbacks** - These reduces the infrastructure losses and human safety risks of sea level rise, storm surge, and erosion.

- **Living shorelines** – These mitigate erosion and protect people and ecosystems from climate change impacts and variability in low to medium energy areas along sheltered coastlines (e.g. estuarine and lagoon ecosystems).

- **Tourism best management practices** – The integration of climate change concerns help to promote the sector's sustainability as well as safeguard against extreme climate events, precipitation change, sea level rise and sea surface warming.

- **Coastal watershed management** – This preserves estuaries, which act as storm buffers.

B. Paper 2

Answer **FOUR** questions in total. Questions carry equal marks.

1. Figure 1 is a representation of the relationship between transport and land use.

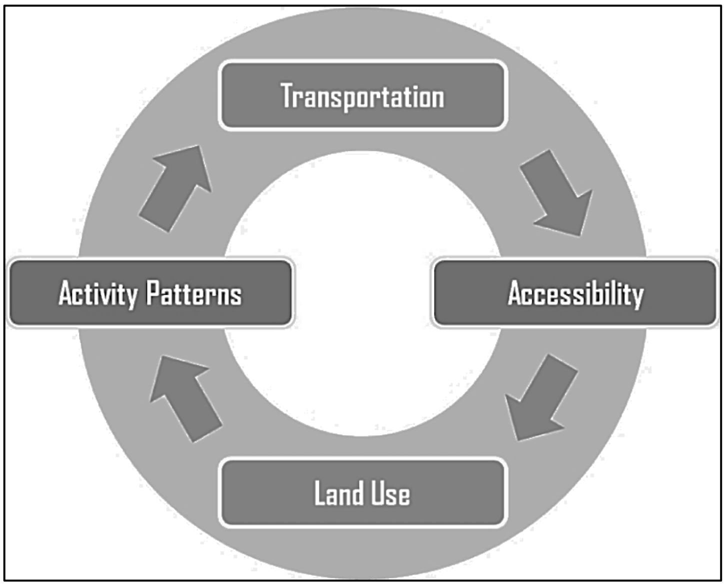


Figure 1: The relationship between transport and land use
(https://transportgeography.org/)

(a) Describe the main concepts shown in Figure 1. (5 marks)

Transport and land use are part of a retroactive feedback system where they influence one-another. Land use, both in formal and functional representations, implies a set of relationships with other land uses, and thus causes movement. For instance, commercial land use involves relationships with its supplier and customers. While relationships with suppliers will dominantly be related with movements of freight, relationships with customers would include movements of people. Hence, a level of accessibility to both systems of circulation must be present. Changes in transport technology, investment and service characteristics can alter overall accessibility levels as well as the relative accessibility of different locations. Land use changes also affect activity patterns. Since each type of land use has its own specific mobility requirements, transport is a factor of activity location, and is associated with land use. Of special importance are the changes in trip generation, both for passenger and freight. Trip patterns may change in a number of ways, such in terms of the number of trips, the timing of trips, their origin or destination, the mode, and trip chaining. These changes in travel demand exert considerable influence on the development of new transport infrastructure or services. As such, the interactions between transport and land use are often referred as a "chicken-and-egg" conundrum because you can start with land use, or you can start with transport; in either case, the basic feedback lead inevitably to a hierarchy of central places and transport links connecting them.

Transport and land use are tied together by a number of factors:

- **Loose, low density sprawl development requires larger distances to reach destinations, i.e. more travel.**

- **Separating all uses instead of mixing them also requires more and longer trips.**
- **Where to live is often decided based on how long it takes to get to work. Time is not only distance but also of speed. The faster a connection and the better the accessibility, the further one can move in a given time and therefore the further away from a job can the place of residence be.**

(b) With reference to your answer for question (a) briefly discuss how the relationship between transport and land use evolved in Malta in recent years. Illustrate your answer with examples. (10 marks)

In the past years Malta experienced substantial urbanisation in various settlements, and this led to urban sprawl in several parts of the islands. Mobility also increased significantly namely due to an improved standard of living, higher incomes, increase in car ownership and improvements in transport systems. Land uses became more diversified and consequently this affected the activity patterns and mobility of people. The accessibility to such land uses improved due to transport technologies and improvements in infrastructures. Recent land use developments are mostly occurring at the periphery of settlements and unfortunately this is encouraging further car use. This is because in most cases it is not possible for people to access such activities using active modes of transport. Such developments, combined with the increase in mobility using the private car are leading to an increase in congestion in the Maltese Islands. Large infrastructure projects tend to precede and trigger land use changes while small scale transport projects tend to complement the existing land use pattern. Malta still lacks a proper integration between transport and land use and this exacerbates the congestion problem.

(c) Describe **FIVE** ways how Malta can strive towards a sustainable urban mobility plan. (10 marks)

- **Improvements in the public transport system.**
- **Improvements in the integration and better coordination between transport and land use**
- **More car-pooling initiatives**
- **More importance and investment in infrastructures related to active modes of transport (walking and cycling). Malta should start giving priority to the pedestrian environment and not just to infrastructures aimed for the car.**
- **More integration between the different modes of transport (e.g. land transport with ferries)**
- **More investments in alternative fuels to petrol/diesel and energy efficient vehicles.**
- **More investment and improvements in road safety.**
- **More disincentives for the use of the private car and incentives to use alternative modes.**

2. Figure 1 shows two population pyramids for Senegal and Malta in 2017.

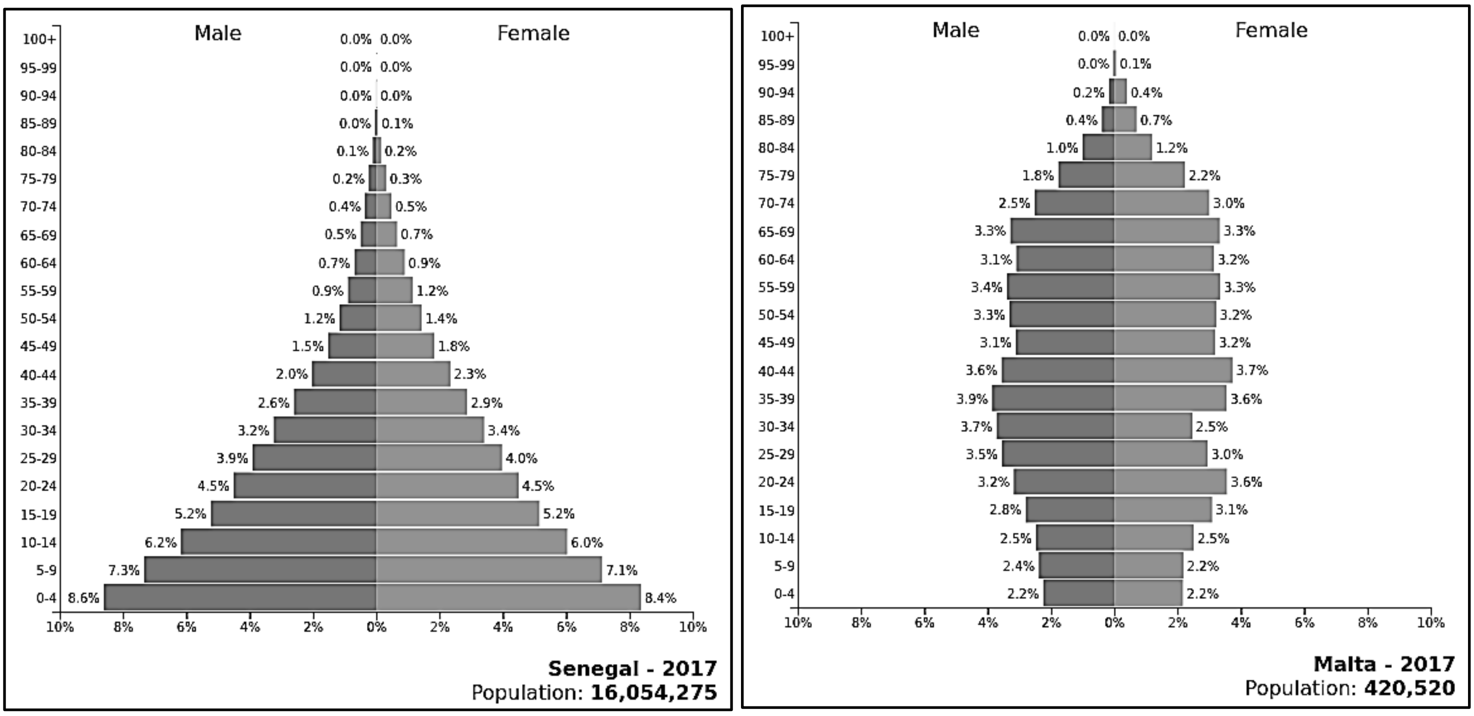


Figure 2: Population pyramids for Senegal and Malta in 2017
(https://www.populationpyramid.net/)

(a) Define population pyramids. Outline what data they represent and why they are useful. (4 marks)

A population pyramid is a graphical representation of age and sex composition of the given population. It shows the proportion of males and females in different age groups. This gives valuable information for human resources planners. For example, if the population pyramid shows a higher proportion of children, then planners can think of controlling birth rate. If it is lower then, they can consider increasing birth rate.

Governments can use population pyramids to help them plan for education. The population pyramid shows the number of children in the country; therefore, governments will know how many schools and teachers will be required in the future. Population pyramids also help governments to plan for the care of older people. If the proportion of the old age population is high, this means that the number of health care facilities for them also needs to increase. Besides, governments may think of increasing the working age population by bringing them from somewhere else. Other people that can use population pyramids for planning purposes are market researchers and product developers.

(b) With reference to Figure 2, discuss the population pyramids for Malta and Senegal in 2017. (12 marks)

- **The population pyramid for Senegal in 2017 had an expansive shape. The proportion of younger people is by far much higher than those over 65 years of age. This was mostly caused due to a high birth rate (wide base) and a rapid fall in each upward age group due to high death rates. One can also assume that Senegal had a high infant mortality rate (although this cannot be confirmed by the pyramid itself). The concave sides show that the population is going to grow. The pyramid indicated a short life-expectancy, most probably ranging between 45 and 55 years**

of age. From the pyramid, one can conclude that the country was still in Stage 2 of the Demographic Transition Model.

- **The population pyramid for Malta in 2017 had a contractive shape. This was mostly caused due to a low birth rate, a low death rate, a high dependency ratio and longer life expectancy. The pyramid shows that in the future the percentage of older people will continue to increase and in the coming years, this segment of the population will make up the largest section of the population in Malta. The birth rate is decreasing and this is clearly shown by the decrease in percentages from the 10 - 14 age group to the 0 – 4 age group. Contracting pyramids are an indication that the child-bearing age groups are not replacing themselves. They are also an indication that the population will decrease in the future, unless external forces such as migration would have an effect on the demography of the country.**

(c) Discuss **TWO** positive and **ONE** negative effects of the current demographic profile in Malta. (9 marks)

The Maltese demographic profile is characterised by an ageing population.

<u>POSITIVE EFFECTS:</u>

- **Community contribution -** The ageing population makes positive contributions to the community through their services. As the life expectancy has increased, most of the baby-boomers will still be physically and mentally healthy when they retire. Voluntary services are a measure of social capital and an indication of a healthy civil society. It has usually been observed that majority of volunteers tend to be older people. Therefore through volunteer services, older people substantially minimize government expenditure on welfare and find satisfaction in providing various other charitable services.
- **Older adults can also be the mainstay of many families and households.** Older people tend to play a role in supporting and maintaining informal social networks, which in turn bind communities and families together. They provide childcare, financial, practical and emotional assistance to family members including helping people outside the household with the tasks of daily living. Grandparents play an important social role in a time when people tend to have more living parents than children. This benefits grandparents directly whom find that this is an important aspect of their lives and makes them feel fulfilled.

<u>NEGATIVE EFFECTS:</u>

- With an increase in the proportion of older people, there will be a decreased proportion of people of workforce age. This means that there will be more people claiming benefits such as state pensions and less people working and paying income taxes, causing an increase in dependency ratio. This will have severe impacts on the working force as they will experience increases in income tax in order to support the increased proportion of older population.

- **Fiscal gap -** The fiscal gap represents an imbalance in revenue and expenditure of the government. An older population would require the government to increase spending on health care and pensions, whilst older people pay lower income taxes as they are not working. A combination of these factors can have a negative impact on the economy.

3. Figure 3 shows the 17 Sustainable Development Goals (SDGs) for 2030. The second goal, 'Zero Hunger', targets ending hunger, achieving food security, improve nutrition and promote sustainable agriculture (United Nations, 2019).

Figure 3: The 17 Sustainable Development Goals for 2030 (United Nations, 2019)

(a) Famine happens when hunger is concentrated and catastrophic. Briefly explain **TWO** causes of famine on a worldwide scale. (5 marks)

Causes of famine:

Famines have always occurred as the result of a complex mix of 'technical' and 'political' factors, but the developments of the modern industrial era have generally reduced the salience of natural constraints in causing famine.

1. **Food supply**

   One might tend to associate famine with drought or other natural phenomena, and indeed most documented famines have occurred in the context of harvest failures, often due to droughts or flooding. However, lack of overall food availability *per se* plays a less prominent role in causing famine today than it did historically.

2. **Poverty**

   Food crises are often precipitated by spikes in the price of food relative to wages, or the collapse in the price of assets owned. The latter commonly accompanies famines due to many people all at once trying to sell their assets (for instance their livestock) in order to be able to buy more food. Such shocks can mean that those already living close to the level of subsistence may find their 'exchange entitlement' – that which they can obtain on the market in exchange for their labour or other assets – fails to provide them with enough food, even if the aggregate local supply is sufficient. African countries have, on the whole, remained very poor and make up the majority of recent famines. Whilst poverty certainly increases the vulnerability of a country, one should be careful not to think of it as the single, or even the most important, cause of famine, given the typically political nature of most outbreaks of famine.

3. **War and famines**

   Many of the major famine events occurred as the consequence of international or civil war. For some of these, famine was used as an intentional part of political or military strategy.

   From the second half of the 20^{th} century onwards, famines in Africa have become increasingly associated with civil war, and include a number of crises in places that were not previously prone to famines at all, such as Mozambique and Biafra in Nigeria. In addition to the direct casualties, conflict can also generate disruption to production and trade and can encourage the spread of disease epidemics, particularly through forced migration. Furthermore, it can also block the arrival of humanitarian relief to those in need.

4. **Poor health and infectious diseases**

   It is important to note that, as opposed to dying from literal starvation, the vast majority of people that die during famines actually succumb to infectious disease or other illnesses, with some diseases being more directly linked to diet than others. Famines brought on by drought often go hand-in-hand with a scarcity of clean drinking water that increases the threat of cholera and other diseases. Increased migration and the disruption of personal hygiene and sanitation routines and healthcare systems also increases the risk of outbreaks of infections, all in the context of a population already weakened through malnourishment. This is particularly true in places where such diseases are already endemic. Thus, in sub-Saharan Africa where vaccination rates for measles have been relatively low, the disease has been a big killer during modern famines in the region alongside other infectious and parasitic diseases common in non-crisis times**.**

(b) Discuss **TWO** unsustainable agricultural practices that can have a negative effect on food security. Support your answer with examples. (8 marks)

<u>Note</u>: answers can vary.

1. **Overuse of chemicals (fertilisers and pesticides):** Not only are the majority of agricultural chemicals toxic to human health, they are also poisoning wildlife and pollinators, running off into water bodies, polluting land, rivers, and wetlands, and destroying important soil microbes that are critical for healthy soils. (Maltese case of overuse of pesticides);
2. **Use of GMOs (Genetically Modified Organisms):** GMOs are not only detrimental to human health, they are detrimental to the environment. GM foods have led to a huge increase in the use of agricultural chemicals being applied to crops, and there have been cases of GM food contamination in non-GMC fields, as well as in soil and water systems. (e.g. HYVs in India, Mexico, and the need to have standards for vegetables and fruit even at an EU level e.g. tomatoes and potatoes);

3. **Growing monoculture crops:** The agricultural practice of growing large swaths of a single crop is leading to deforestation, widespread use of heavy machinery, and a large use of agricultural chemicals. (e.g. the problem with superfoods and plantations)
4. **Growing crops on every inch of land:** With the pressure from global markets to increase production, many farmers are producing crops on the entirety of their land. In many cases, there are no more "buffer strips" to protect waterways from erosion or runoff, or for habitat that remains for native species. (e.g. intensive agriculture in small land areas around Europe)
5. **Wasting water:** current agricultural practices are typically inefficient in water use. Problems such as growing high water demand crops, leaky and inefficient irrigation infrastructure, the unsustainable draining of aquifers to produce crops, and water runoff into rivers and other water bodies are a sign that we can improve greatly with how we use water to grow our food. (e.g. over extracting of water in the Mediterranean)

(c) "Over the centuries, indigenous peoples have provided a series of ecological and cultural services to humankind. The preservation of traditional forms of farming knowledge and practices help maintain biodiversity and enhance food security". (https://www.resilience.org). Explain **THREE** indigenous agricultural practices that enhance food security. (12 marks)

Note: answers can vary.

- **Agroforestry** – involves the deliberate maintenance and planting of trees to develop a microclimate that protects crops against extremes. Blending agricultural with forestry techniques, this farming system helps to control temperature, sunlight exposure, and susceptibility to wind, hail, and rain. This system provides a diversified range of products such as food, fodder, firewood, timber, and medicine while improving soil quality, reducing erosion, and storing carbon;

- **Crop rotations** – the principles of crop rotation have been successfully used for thousands of years in agriculture and are still used today. Crop rotation is the practice of growing different crops on the same land so that no bed or plot sees the same crop in successive seasons. It is a practice designed to preserve the productive capacity of the soil, minimise pests and diseases, reduce chemical use, and manage nutrient requirements, all of which help to maximise yield. The practice of crop rotation builds better soil structure and increases the ability to store carbon on farms;

- **Mixed / inter-cropping** - Mixed cropping, also known as intercropping, is a system of cropping in which farmers sow more than two crops at the same time. By planting multiple crops, farmers can maximize land use while reducing the risks associated with single crop failure. Intercropping creates biodiversity, which attracts a variety of beneficial and predatory insects to minimize pests and can also increase soil organic matter, fumigate the soil, and suppress weed growth;

- **Polyculture** - Polyculture systems involve growing many plants of different species in the same area, often in a way that imitates nature. By increasing plant biodiversity, polyculture systems promote diet diversity in local communities, are more adaptable to climate variability and extreme weather events, and are more resilient to pests and diseases. Polycultures are integral to permaculture systems and design and provide many advantages such as better soil quality, less soil erosion, and more stable yields when compared to monoculture systems;

- **Water harvesting** - Water harvesting is defined as the redirection and productive use of rainfall, involving a variety of methods to collect as much water as possible out of each rainfall. Many water harvesting structures and systems are specific to the ecoregions and culture in which it has been developed. This may involve collecting water from rooftops, from swollen streams and rivers during monsoon season, or from artificially constructed catchments. This ensures that farmers have a substantial amount of water stored up in the case of drought or limited rainfall.

4. The Conference of Parties (COP) 21 that took place in Paris, France in 2015 was a landmark meeting for the United Nations Framework Convention on Climate Change (UNFCCC). The Paris Agreement was reached during COP 21 (UNFCCC, 2019).

(a) What is the Paris Agreement? (5 marks)

The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. Additionally, the agreement aims to increase the ability of countries to deal with the impacts of climate change, and at making finance flows consistent with a low GHG emissions and climate-resilient pathway. To reach these ambitious goals, appropriate mobilization and provision of financial resources, a new technology framework and enhanced capacity-building is to be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives. The Agreement also provides for an enhanced transparency framework for action and support.

(b) Describe **TWO** ways in which countries can contribute to achieve the Paris Agreement. (10 marks)

Note: answers may vary and can include ideas that still contribute to the below:

1. **Mitigation** – The Paris Agreement establishes binding commitments by all Parties to prepare, communicate and maintain a nationally determined contribution (NDC) and to pursue domestic measures to achieve them. It also prescribes that Parties shall communicate their NDCs every 5 years and provide information necessary for clarity and transparency. To set a firm foundation for higher ambition, each successive NDC will represent a progression beyond the previous one and reflect the highest possible ambition. Developed countries should continue to take the lead by undertaking absolute economy-wide reduction targets, while developing countries should continue enhancing their mitigation efforts, and are encouraged to move toward economy-wide targets over time in the light of different national circumstances.

2. **Sinks and reservoirs** - The Paris Agreement also encourages Parties to conserve and enhance, as appropriate, sinks and reservoirs of GHGs, including forests.

3. **Voluntary cooperation/Market- and non-market-based approaches** – The Paris Agreement recognizes the possibility of voluntary cooperation among Parties to allow for higher ambition and sets out principles – including environmental integrity, transparency and robust accounting – for any cooperation that involves internationally transferal of mitigation outcomes. It establishes a mechanism to contribute to the mitigation of GHG emissions and support sustainable development, and defines a framework for non-market approaches to sustainable development.

4. **Adaptation** – The Paris Agreement establishes a global goal on adaptation – of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change in the context of the temperature goal of the Agreement. It aims to significantly strengthen national adaptation efforts, including through support and international cooperation. It recognizes that adaptation is a global challenge faced by all. All Parties should engage in adaptation, including by formulating and implementing National Adaptation Plans, and should submit and periodically update an adaptation communication describing their priorities, needs, plans and actions. The adaptation efforts of developing countries should be recognised.

5. **Loss and damage** – The Paris Agreement recognises the importance of averting, minimising and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of loss and damage. Parties are to enhance understanding, action and support, including through the Warsaw International Mechanism, on a cooperative and facilitative basis with respect to loss and damage associated with the adverse effects of climate change.

6. **Finance, technology and capacity-building support** – The Paris Agreement reaffirms the obligations of developed countries to support the efforts of developing country Parties to build clean, climate-resilient futures, while for the first time encouraging voluntary contributions by other Parties. Provision of resources should also aim to achieve a balance between adaptation and mitigation. In addition to reporting on finance already provided, developed country Parties commit to submit indicative information on future support every two years, including projected levels of public finance. The agreement also provides that the Financial Mechanism of the Convention, including the Green Climate Fund (GCF), shall serve the Agreement. International cooperation on climate-safe technology development and transfer and building capacity in the developing world are also strengthened: a technology framework is established under the Agreement and capacity-building activities will be strengthened through, inter alia, enhanced support for capacity building actions in developing country Parties and appropriate institutional arrangements.

7. **Climate change education, training, public awareness, public participation and public access to information** is also to be enhanced under the Agreement.

8. **Transparency implementation and compliance**– The Paris Agreement relies on a robust transparency and accounting system to provide clarity on action and support by Parties, with flexibility for their differing capabilities of Parties. In addition to reporting information on mitigation, adaptation and support, the Agreement requires that the information submitted by each Party undergoes international technical expert review. The Agreement also includes a mechanism that will facilitate implementation and promote compliance in a non-adversarial and non-punitive manner, and will report annually during the COP.

9. **Global Stocktake** – Countries to contribute to the "global stocktake", to take place in 2023 and every 5 years thereafter, will assess collective progress toward achieving the purpose of the Agreement in a comprehensive and facilitative manner. It will be based on the best available science and its long-term global goal. Its outcome will inform Parties in updating and enhancing their actions and support and enhancing international cooperation on climate action.

(c) In 2018 (three years after the landmark meeting in Paris), during COP 24, negotiations regarding the Paris Agreement were still being discussed. Overall, COP 24 was a success but striking the perfect balance between different countries can lead to several issues. Explain **TWO** major issues faced by countries to achieve the Paris Agreement. (10 marks)

Note: answers can vary.

1. **Economies still geared towards the use of fossil fuels** means that the transition to low-emissions, climate-resilient development pathways will require broader, transformative change. Policy action needs to go beyond core climate policies address policy misalignments and social and distributional issues as well as implementing the structural reforms needed to allow economies to adjust to the transformational changes that will be required.

2. **Achieving the goals of the Paris Agreement will require emission reductions beyond industry and energy sectors**. Globally, emissions from agriculture, forestry and other land-use (AFOLU) contribute around a quarter of total GHG emissions. Land sectors act as both a source of GHGs, for example methane from livestock and rice, carbon dioxide from land-clearing, and nitrous oxide from fertiliser use, and as a sink for greenhouse gases (e.g. sustainable forestry). This means that land-use decisions have an important influence over the carbon budget remaining for energy and industry sectors.

3. **The world faces a huge challenge in meeting global food demand, while mitigating and adapting to climate change, and conserving biodiversity** – Some forms of land-based mitigation actions such as monoculture plantations and using land to grow first-generation biofuels can negatively impact biodiversity, the availability and supply of food and water and ecosystem resilience. Other mitigation actions such as ecosystem-based approaches (e.g. agroforestry and ecosystem restoration) and climatesmart agriculture can have positive benefits for both biodiversity and human well-being, while mitigating climate change and enhancing resilience.

4. **Enhancing resilience will require capacity development and policy reforms** - Current development patterns are often increasing countries' exposure to climate change impacts: for example, through the growth of low-lying coastal cities or the degradation of ecosystems and the services they provide. These patterns can lock-in vulnerabilities to climate change that will be difficult and expensive to reverse in future. To prevent this, there needs to be sufficient awareness and data to understand climate risks. This needs to be combined with the capacity and tools for managing those risks given uncertainty about the future. Policies should address misalignments (such as inappropriate land-use planning) that increase exposure to climate risks.

5. There is also the need to determine how the goal of **building adaptive capacity** can be measured. Relatively few countries have developed national monitoring and evaluation systems for adaptation. Assessing the effectiveness of adaptation will require a coordinated approach to aggregate information horizontally across climate-sensitive sectors as well as vertically across different levels of government. The processes and outputs of national adaptation monitoring and evaluation systems could inform Parties' communication of progress and help assess whether the global goal on adaptation is being achieved.

6. The transition to **low emissions, climate-resilient development pathways needs to be inclusive**. The transition of exposed businesses and households, particularly in vulnerable regions and communities, and early planning to avoid stranded assets in fossil-fuel-intensive industries and stranded communities alongside them are as essential to the transition as core climate policies and policy alignment across the economy. Vulnerability to climate change is closely linked to socio-economic vulnerability: measures to reduce poverty and social exclusion will help vulnerable groups adapt to climate change.

5. The European Union is in the final stages of adopting a legislation that targets the reduction of CO_2 emissions from cars and vans (European Commission, 2019). The need for this legislation derives from the fact that such vehicles are major contributors to air pollution in urban areas.

(a) Discuss **TWO** ways how transport-induced air pollution is affecting people in urban areas. (8 marks)

- **Health**: an increased risk of death, particularly from cardiopulmonary causes, and it increases the risk of non-allergic respiratory symptoms and disease. Pollutants include CO_2, NO_x, SO_2, $PM_{2.5}$, and PM_{10}. Children, including unborn babies and the elderly are the most vulnerable groups that suffer from such pollution.

- **SMOG**: Is the result of smoke (which results from polluting vehicles) and fog. Apart from making breathing difficult and causes irritations to the eyes, smog reduces visibility making it dangerous for people to move around in the urban area.

- **Inconvenience**: smell of pollution leads to inconvenience. People have to close windows and doors. Areas that suffer from heavy traffic are covered in soot, which is visually unpleasant and a cause for concern for people living in those areas.

(b) Explain, using **THREE** examples, how mobility can become sustainable. In your answer refer to how this issue is being tackled in the Maltese Islands. (17 marks)

- **Use alternative modes of transport** such as public transport, walking and cycling, car sharing and carpooling – using alternative modes of transport to the car helps reducing single user vehicles and increase sustainable mobility. Public transport is a services that caters for large amounts of people. Walking and cycling are active modes of travel that apart from being clean modes of transport, because they do not pollute, they enhance a healthy lifestyle.

- Implement **policies that reduce car use** e.g. congestion charging, pedestrianisation – governments should implement such policies to ensure that the amount of cars on the road are reduced. Some policies may serve as carrots (e.g. pedestrianisation or subsidies for public transport) to encourage people to use alternative modes of transport, and other policies may serve as sticks (e.g. congestion charging) to discourage the use of single user vehicles.

- Use Mobility As A Service (**MAAS**) – use technology such as mobile applications that simply interchanging between different transport modes – technologies and ICT can be used to facilitate the use of different modes of transport and improve interchanging by providing multiple modes at the right time (encouraging punctuality) and reducing the need to pay per service, thus wasting time.

- Reduce **parking** and parking related problems – the more there is supply for parking the demand for cars increases; by reducing parking spaces, cars decrease. Furthermore, difficulties in finding parking lead to traffic congestion and cars cruising around, which lead to air and noise pollution. Hence, reducing parking and implement parking intelligent systems improves the situation and promotes sustainable mobility.

- Combine **transport policy with land use policy** – Policies related to transport and land use should always be combined. In places where there are high densities multiple modes of transport can be implemented for people to have different options available from which to choose.

- Increase **accessibility** for all – roads should not be designed for the cars but should consider every member of society, thus including disabled groups, vulnerable groups and different users of varying modes of transport. Accessibility for all increases equity.

- Use **clean technologies** – vehicles (e.g. cars and public transport) should be designed to pollute less and use environment friendly sources of energy.

6. Figure 4 shows the number of international tourist arrivals by world region between 1950 and 2016.

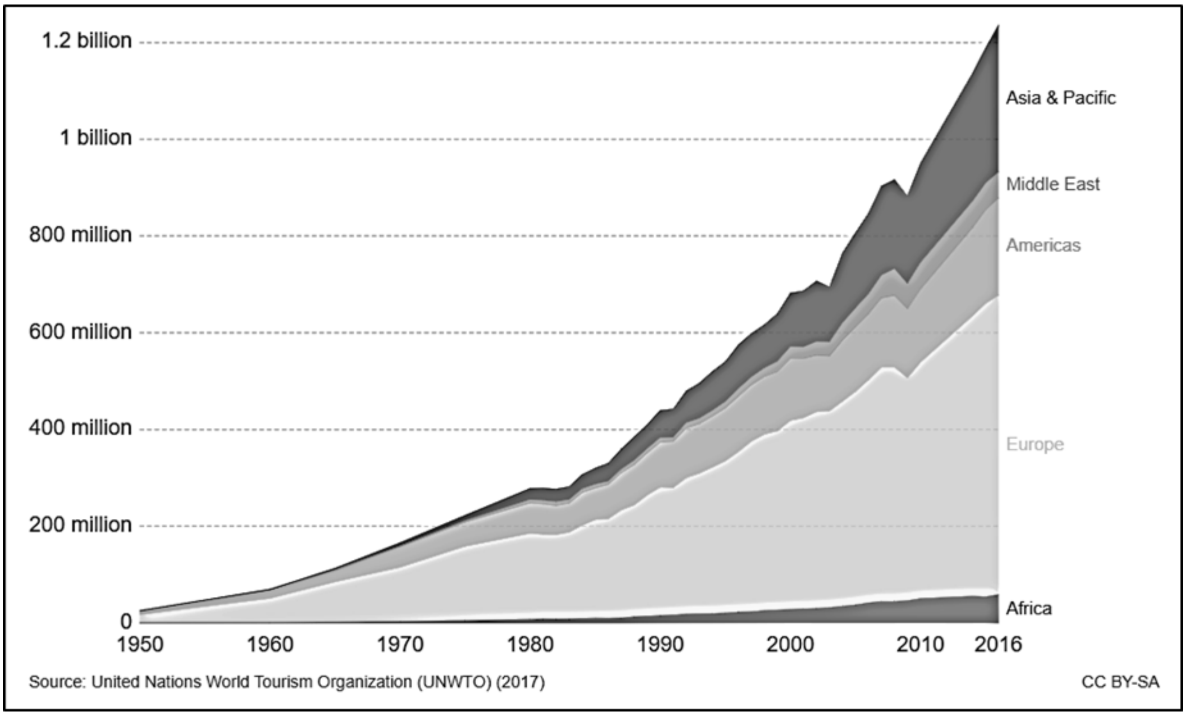


Figure 4: International tourist arrivals by world region
(https://ourworldindata.org/tourism)

(a) Outline the key findings of Figure 4. (5 marks)

Figure 4 shows how tourist arrivals have increased since shortly after the World War II in 1950. The United Nations World Tourism Organization (UNWTO) estimates that internationally there were just 25 million tourist arrivals in 1950. In 2016 this number has increased to 1.2 billion international arrivals per year (a 49-fold increase). The increase was practically in all continents. However the highest increase was in Europe reaching over 600 million tourist arrivals in 2016. This was followed by Asia & Pacific and the Americas. The increase in the tourist arrivals for Asia and Middle East was steeper than that of Europe and the Americas. The lowest continent for tourist arrivals remained Africa. All continents (except Africa) suffered a decrease in their tourist arrivals in 2009 because of the global recession.

(b) Discuss **THREE** factors that affected the growth of the global tourism industry in these past 40 years. (6 marks)

- **Greater affluence and improved standard of living** – People in employment earn higher salaries and their disposable income is much greater. Some people in full-time employment also receive holiday with pay, allowing them to take more than one holiday a year and travel further.

- **Greater mobility** – The increase in car ownership has given people greater freedom to choose where and when they go. Chartered aircrafts also reduced the costs of overseas travel.

- **Improved accessibility and transport facilities** – Improvements in roads, especially motorways have reduced driving times between places and encourages people to travel more frequently and for longer distances. Improved and enlarged international airports also contributed to the increase in tourism.

- **Technological developments** – jet aircrafts, computerised reservation systems, use of the internet.

- **Product development and innovation** – holiday camps, long-haul destinations, package tours.

- **Changing lifestyles** – People at work need longer and more frequent rest periods as pressure of work increased. The increase in the ageing population is also increasing certain types of tourism packages as older people are remaining very active.

- **Advertising and TV programmes** – holiday programmes, magazines, brochures, social media and the internet in general promote new and different destinations and activities.

- **Green and sustainable tourism** – People are more aware of the importance to exploit the environment in a sustainable manner. This is increasing certain types of tourism packaged e.g. agro-tourism, eco-tourism.

- **Improvement in the accommodation offered** – Different accommodation packages are being offered which can target different types of tourists with their specific interests.

(c) Discuss **TWO** positive and **TWO** negative social impacts resulting from the growth of tourism.

(8 marks)

POSITIVE social impacts:

- Cultural exchange stimulates broadening of horizons and reduction of prejudices amongst tourist visitors and host population.
- Encourages education.
- Encourages travel, mobility and social integration.
- Improves services (e.g. electricity and health), transport (new roads, airports) and widens range of shops and leisure amenities.
- May enhance the status of women in society, as opportunity for goals in tourism is created and outlook is widened.

NEGATIVE social impacts:

- May cause polarisation between populations in advancing tourist regions and less developed areas, creating a “dual society”.
- Increases rift between “rich” and “poor”.
- Increases health risks.

- Breakdown of traditional family values can create material aspirations.
- Social pathology, including drugs and petty crime.
- Tourism may create antagonism from host population who are concerned for traditional values e.g. religion.

(d) Discuss **TWO** ways how the European Union (EU) is supporting sustainable tourism. (6 marks)

- **As part of its work in diversifying the tourism experiences on offer in the EU, the Commission co-funds sustainable transnational tourism products that can contribute to tourism growth. These are thematic products and services in areas such as environmentally friendly tourism including cycling routes, sports and wellbeing tourism and nature tourism.**
- **Since tourist destinations are increasingly called upon to measure their performance in relation to sustainability, the Commission has developed a European Tourism Indicators System as a simple method for measuring sustainability performance.**

- **The European Union incorporates sustainability in tourism related policies/actions. It encourages Member States and tourism stakeholders to develop more sustainable tourism (by exchange of good practice, assisting and providing a supportive policy framework).**

- **The EU developed the European Destinations of Excellence "EDEN" initiative. Amongst other initiatives it rewards sustainable forms of tourism. It also promotes networking between awarded destinations to persuade other destinations to adopt sustainable tourism development modes.**

- **The EU Eco-label and EMAS initiatives - The EU Eco-label is a voluntary tool that is available to tourism accommodation services willing to prove and promote their environmental excellence. Specific EU Eco-label criteria have been developed for tourist accommodation and campsite services. EMAS registration allows actors in the tourism sector to improve their environmental performance and promote the quality of their services.**