

READ THIS BEFORE USING THE ANSWERS

- 1 mark: one precise fact/term;
- 2 marks: two distinct points unless the question wording requires a different structure.
- 3 marks: three identifiable descriptive features, including relevant data only when a source is provided.
- 4 marks: "explain two" response uses two developed reasons, normally cause + linked consequence for each.
- 5 marks ("assess"): offer several explained, relevant considerations and weigh their relative significance; a reasoned overall statement can strengthen an assessment but do not impose a rigid point-by-point marks formula.
- 8 marks ("how far" or evaluate): developed arguments, a credible alternative view, accurate named examples and supported judgement. Section A is level-marked; marks are not prescribed separately for evidence or judgement.
- Time guide (recommendation):
1 mark ~1 min;
2 marks ~2–3 min;
3 marks ~4 min;
4 marks ~5–6 min;
5 marks ~7 min;
8 marks ~10–11 min.
Keep time for source reading and checking; the full 75-mark paper takes 105 minutes.
- Some headings and questions in the question bank go beyond the narrowly worded syllabus or combine themes from neighbouring units. They are retained as supplied; teachers should check the syllabus before using them in formal assessment.

1-MARK QUESTIONS

[1 marks] Name the sea south of Pakistan.

The Arabian Sea.

Examiner focus: One precise fact; no explanation.

[1 marks] Identify one country bordering Pakistan to the west.

Iran. (Afghanistan is also a valid western/northwestern neighbour.)

Examiner focus: Give one country, not a list.

2-MARK QUESTION

[2 marks] Give two reasons why location affects climate.

1. Pakistan's location on the Arabian Sea moderates temperatures in its coastal areas.
2. Its position in the path of summer monsoon winds allows moist air to bring seasonal rain, especially to eastern and northern areas.

Examiner focus: Two distinct geographical reasons. The named climatic mechanisms make the

points unambiguous.

4-MARK QUESTION

[4 marks] Explain two ways location affects trade.

First, Pakistan's Arabian Sea coastline provides access to shipping routes through Karachi and Port Qasim, allowing imports and exports to move by sea. Second, its land borders and routes through passes such as Khunjerab connect Pakistan with neighbouring markets, including China, creating opportunities for overland trade; mountainous terrain and border restrictions can, however, constrain these links.

Examiner focus: Two linked, developed explanations; named examples are applied to the correct mechanism.

5-MARK QUESTION

[5 marks] Assess the importance of Pakistan's location for economic development.

Pakistan's coastline is important for international trade because Karachi and Port Qasim handle sea-borne imports and exports, supporting transport, logistics and industrial employment. Its position between South Asia, China and western neighbouring states also creates opportunities for overland trade, including links through Khunjerab. However, location alone cannot secure development: mountainous routes increase construction costs and cross-border trade depends on political conditions and reliable infrastructure. Its location creates substantial potential, but investment and accessibility determine how much of that potential becomes economic growth.

Examiner focus: Developed importance, contrasting limitations and a proportionate assessment.

8-MARK QUESTION

[8 marks] "Pakistan's location is mainly an advantage." How far do you agree? Evaluate the importance of Pakistan's location for development.

Pakistan's position is an economic advantage in several ways. Its Arabian Sea coastline provides access to international shipping; Karachi and Port Qasim allow businesses to import machinery and export manufactured goods. It also borders China, Afghanistan, Iran and India, giving it potential to connect regional markets. The Khunjerab route and the Karakoram Highway, for example, provide an overland link with China. Its coastal and regional position can encourage investment in trade, logistics and industry.

However, geography can also create constraints. The northern mountains make road and rail construction difficult and costly, while distances between ports and remote inland settlements can limit access to markets. Trade through some neighbouring states can be disrupted by border controls and political tensions, so proximity does not automatically create economic integration. Coastal areas also face hazards such as cyclones and storm surges, requiring protective infrastructure. Overall, I agree to a considerable extent that location gives Pakistan major opportunities, especially through its ports and links with China. However, the benefits depend on transport infrastructure, border access and how effectively the country manages physical hazards. Location is an advantage, not a guarantee of development.

Examiner focus: Level 3 target: developed argument, alternative viewpoint, specific examples and supported judgement; not a guaranteed score.

1-MARK: RIVERS, RELIEF AND CLIMATE

[1 marks] Name the longest river in Pakistan.

The Indus River.

[1 marks] Name one western tributary of the Indus River.

The Kabul River.

[1 marks] What is the highest peak in Pakistan?

K2.

[1 marks] Which plateau is found in western Pakistan?

The Balochistan Plateau.

[1 marks] What is a desert found in Pakistan?

The Thar Desert.

[1 marks] Which winds bring rain to Pakistan in summer?

The summer monsoon winds.

[1 marks] What is the wettest season in Pakistan?

Summer, during the monsoon season.

2-MARK: RIVERS, RELIEF AND CLIMATE

[2 marks] Give two uses of river water in Pakistan.

Irrigation of farmland and the generation of hydroelectric power.

[2 marks] State two sources of water for rivers.

Snow/glacier melt and rainfall.

[2 marks] Name two mountain ranges in Pakistan.

The Karakoram and the Himalayas.

[2 marks] State two characteristics of deserts in Pakistan.

Very low rainfall and sparse natural vegetation.

[2 marks] State two characteristics of monsoon rainfall.

It mainly falls during the summer months and can occur in heavy, intense downpours.

[2 marks] Give two reasons why coastal areas have moderate temperatures.

The sea heats and cools more slowly than land, limiting seasonal temperature extremes; onshore sea breezes bring relatively cooler air onto the coast during hot weather.

3-MARK: DESCRIPTIVE ANSWERS

[3 marks] Describe how river flow changes throughout the year.

Flow is generally lower in winter when low temperatures reduce snow and glacier melt. It increases in spring and early summer as rising temperatures accelerate melting in northern catchments. River discharge is usually highest in summer when meltwater combines with monsoon rainfall, raising flood risk.

Examiner focus: Three distinct seasonal observations, not explanations of dam management.

[3 marks] Describe the characteristics of the Indus Plain.

The Indus Plain is an extensive low-lying area of flat or gently sloping land across much of Punjab and Sindh. It contains fertile alluvial soils deposited by the Indus and its tributaries. A network of rivers, canals and floodplains supports intensive irrigation and agriculture.

Examiner focus: Three characteristics with geographical vocabulary.

[3 marks] Describe the relief of the Balochistan Plateau.

It is an elevated, mostly arid region of western Pakistan with rugged mountain ranges. Broad basins and valleys lie between the ranges. Much of the terrain is steep or uneven, making access more difficult than on the Indus Plain.

Examiner focus: Relief means height, shape and slope, not climate alone.

[3 marks] Describe the distribution of rainfall in Pakistan.

Rainfall is generally higher in the northern and northeastern uplands, including the Murree area, than in the southwest. Much of Balochistan and the western desert areas receive very low annual rainfall. Monsoon rain is concentrated mainly in summer and generally decreases westwards away from the main moisture-bearing winds.

Examiner focus: Spatial distribution and seasonality. Use graph figures only when a graph is supplied.

[3 marks] Describe seasonal temperature variations in Pakistan.

Most lowland areas are coolest in winter, especially December–January, and hottest in late spring and early summer. Inland places such as Jacobabad have much larger seasonal extremes than Karachi on the coast. Northern highlands remain cooler throughout the year, with very cold, often freezing winters at high altitude.

Examiner focus: Three distinct seasonal or regional contrasts.

4-MARK: TWO DEVELOPED EXPLANATIONS

[4 marks] Explain how mountains affect human activities.

Steep slopes and rugged valleys make it expensive to build roads, so isolated northern settlements have more limited access to services and markets. Mountains also provide steep, fast-flowing rivers suitable for hydroelectric power, while mountain landscapes such as Hunza attract tourism and related employment.

Examiner focus: Two clearly explained impacts; the second illustrates economic opportunity.

[4 marks] Explain why coastal areas have moderate temperatures.

SYLLABUS PLACEMENT Main focus: 1.2.1 / 1.2.2. Weather/climate characteristics or controls belong under Topic 1.2, beyond the 1.1.2 landform emphasis.

Water heats and cools more slowly than land, so the Arabian Sea absorbs heat during summer and releases it more gradually in winter, reducing temperature extremes near Karachi. During hot periods, onshore sea breezes bring cooler air from over the sea onto the land, moderating daytime coastal temperatures compared with inland cities such as Jacobabad.

Examiner focus: Two processes, each with cause and effect; avoid saying coastal climates are uniformly cool.

5-MARK: ASSESSMENT

[5 marks] Assess the causes of flooding in Pakistan.

Intense monsoon rainfall can overwhelm drainage and rapidly raise river levels, especially when rain falls across large parts of the Indus catchment. Snow and glacier melt can add water to rivers during summer, increasing discharge; in some northern valleys, glacial-lake outburst floods create sudden local hazards. Human factors can make a flood more destructive: deforestation increases surface runoff, and construction on floodplains exposes more homes and farmland. For extensive Indus-basin floods, unusually heavy rainfall is often the immediate trigger, but poor drainage, vulnerable settlement and land-use decisions greatly influence severity. The 2022 floods in Sindh illustrate the combined scale of rainfall and exposure.

Examiner focus: Weigh physical causes against human amplification; 2022 is a named historical example, not a claim that every flood has the same causes.

[5 marks] Assess the advantages and disadvantages of living in mountainous areas.

Mountains provide tourism jobs in places such as Hunza and opportunities for hydropower where rivers descend steeply. Cooler summer temperatures and some sheltered valleys can also favour fruit growing. However, steep relief makes roads, hospitals and other services expensive to provide, while landslides and winter snow can isolate settlements. The advantages depend strongly on local accessibility: accessible tourist valleys may benefit economically, whereas remote high-altitude communities face greater constraints.

Examiner focus: Balanced evaluation with a contextual conclusion rather than a generic advantage/disadvantage list.

8-MARK: DEVELOPED EVALUATIONS

[8 marks] "Rivers are the most important natural resource in Pakistan." How far do you agree? Give reasons for your answer.

Rivers are extremely important because Pakistan's agriculture relies heavily on irrigation from the Indus system. Barrages and canals distribute river water across the fertile Indus Plain, allowing crops to grow in places where rainfall alone is insufficient. Rivers also provide hydroelectric power at facilities such as Tarbela, reducing dependence on some imported fuels. They supply water for homes and industry and support ecosystems and fisheries. These wide-ranging uses make water a foundation of both livelihoods and economic activity.

However, other natural resources also support development. The country's forests, including Indus Delta mangroves, protect coastlines, support fisheries and reduce erosion. Mineral deposits such as copper at Saindak and Reko Diq create opportunities for industrial production and export earnings. Fertile alluvial land is another crucial asset. Moreover, rivers alone do not guarantee water security: poor storage, pollution and inefficient irrigation can reduce their value.

On balance, rivers are arguably Pakistan's most widely used natural resource because they underpin agriculture, energy and domestic water supply simultaneously. Nevertheless, their value depends on careful management, and forests, minerals and productive land also make indispensable contributions.

Examiner focus: Alternative viewpoint plus named examples and supported degree of agreement.

[8 marks] Assess the impacts of flooding in Pakistan. Give reasons and examples to support your answer.

Flooding has major social and economic impacts in Pakistan. Floodwater can damage homes and displace families, interrupting education and increasing exposure to unsafe drinking water and waterborne disease. The 2022 floods, particularly in Sindh and Balochistan, illustrate how widespread inundation can force people into temporary shelters and disrupt basic services.

Agriculture is especially vulnerable when standing crops are submerged, stored grain is lost and livestock die. Flooded roads, bridges and electricity installations then delay food transport and business recovery, while governments face high reconstruction costs. Environmental damage may include erosion and contamination of drinking-water sources. However, less destructive seasonal flooding can deposit fertile silt and recharge some groundwater, so not every flood produces only negative consequences.

The most serious impacts are often the longer-term loss of housing, livelihoods and access to services, particularly in poorer floodplain communities with limited savings. Effective warnings, safer land use and resilient infrastructure can reduce these losses, meaning the consequences depend on vulnerability as well as flood magnitude.

Examiner focus: Discuss social, economic and environmental consequences and distinguish floods from flood disasters.

A. FORESTS

1-MARK QUESTIONS

[1 mark] Name one forest type found in northern Pakistan.

Coniferous forest.

[1 mark] Name one use of mangrove forests.

Protecting the coast from erosion and storm waves.

2-MARK QUESTIONS

[2 marks] State two uses of forests in Pakistan.

Forests supply timber for furniture and construction, and fuelwood for cooking or heating.

[2 marks] Give two causes of deforestation.

Cutting trees for household fuelwood; clearing forest land for agriculture or settlements.

[2 marks] State two environmental benefits of forests.

Tree roots bind soil and reduce erosion; forest vegetation intercepts rainfall and slows surface runoff.

3-MARK QUESTIONS

[3 marks] Describe the characteristics of coniferous forests.

Coniferous forests are usually evergreen, with trees bearing needle-shaped leaves and cones. Many have tall, straight trunks with branches shaped to shed snow. They grow mainly in cooler, higher-altitude northern areas such as Swat and Kaghan, where pine, fir and spruce are found.

Examiner focus: Three distinguishable characteristics; a named location supports precision but is not mandatory unless specified.

[3 marks] Describe the importance of mangrove forests.

Mangroves stabilise coastal mud and help reduce wave erosion and storm impacts. Their roots provide breeding and nursery habitats for fish, prawns and other wildlife, supporting coastal fisheries. They also trap sediment and store carbon, benefiting the Indus Delta environment.

Examiner focus: Describe three distinct benefits; do not give only vague "help environment" statements.

4-MARK QUESTIONS

[4 marks] Explain how deforestation affects soil.

Removing trees leaves soil exposed to direct rainfall because there is less canopy interception and leaf litter. Heavy rain can then wash fertile topsoil downslope, lowering soil fertility. Losing tree roots also reduces soil binding, making steep slopes more vulnerable to gully and landslides, particularly in northern valleys.

Examiner focus: Two developed pathways: canopy/erosion and roots/slope instability.

[4 marks] Explain how forests help reduce climate change.

Through photosynthesis trees absorb carbon dioxide and store carbon in wood and soil, reducing the amount of this greenhouse gas in the atmosphere. Protecting existing forests also prevents some stored carbon from being released through burning or decay after clearance, helping limit emissions.

Examiner focus: Two explained mechanisms: sequestration and avoiding emissions. Do not claim forests alone can stop climate change.

5-MARK QUESTIONS**[5 marks] Assess the importance of forests for local communities.**

Forests are important to many rural communities because they supply fuelwood and timber, especially where alternative energy and construction materials are costly. In northern areas such as Swat and Gilgit-Baltistan, forests also support livelihoods through managed timber, tourism, fodder and other forest products. Their roots reduce erosion and slope instability, protecting land and settlements, while mangroves in the Indus Delta support fisheries and coastal protection. However, communities depending on excessive wood extraction can undermine the resource they rely on. The importance of forests therefore extends beyond income to protection of land and livelihoods, provided use is sustainable.

Examiner focus: Several developed and geographically distinct benefits, including a limitation rather than a generic list.

[5 marks] Assess the causes of deforestation in Pakistan.

Fuelwood demand is an important driver in remote northern communities where gas or electricity supplies are limited. Timber cutting for construction and commercial use also removes trees, while expansion of farming, roads and settlements converts forest land permanently. Grazing may prevent young trees from regenerating after clearance. The relative importance varies: demand for household energy can be especially significant in remote mountain valleys, whereas land conversion and urban expansion are stronger pressures around growing settlements. Weak enforcement can worsen several of these causes.

Examiner focus: Distinguish direct drivers from conditions that intensify them.

8-MARK QUESTIONS**[8 marks] Assess the effectiveness of methods used to reduce deforestation in Pakistan. Give reasons and examples to support your answer.**

Afforestation and reforestation can increase tree cover and restore damaged hillsides. The Ten Billion Tree Tsunami Programme, described in the textbook, includes new planting, natural regeneration and forest protection in several regions. Tree cover can reduce soil erosion and support biodiversity, but planted trees take years to mature, survival rates may be low in dry areas, and protection from grazing and illegal felling is essential. Planting totals alone do not prove lasting recovery.

Community involvement and protection of existing forests can address these weaknesses. In northern areas, schemes involving local residents in forest management can provide income and improve monitoring. Expanding affordable alternatives to fuelwood, such as gas, electricity or other suitable energy sources, can reduce the demand driving repeated cutting. However, alternatives need reliable access and household affordability; enforcement alone may harm communities that have few other fuel options.

Overall, the most effective long-term approach combines protection of existing forests, natural regeneration or planting suited to local conditions, and affordable alternatives to fuelwood. Its success should be judged by surviving forest cover, reduced erosion and benefits to communities, not the number of saplings planted.

Examiner focus: Level 3 target: developed reasoning, alternative considerations, named examples and supported judgement; no guaranteed mark.

B. MINERALS

1-MARK QUESTIONS

[1 mark] Define the term non-renewable resource.

A natural resource that cannot be replaced within a human timescale once it has been used.

[1 mark] Name one metallic mineral found in Pakistan.

Copper.

[1 mark] Name one location of coal deposits.

The Thar coalfield in Sindh.

2-MARK QUESTIONS

[2 marks] State two uses of minerals.

Limestone is used to make cement; rock salt from Khewra is used in food and chemical production.

[2 marks] Give two problems caused by mining.

Mine waste can contaminate nearby rivers or groundwater; blasting and haulage generate dust that reduces air quality.

3-MARK QUESTIONS

[3 marks] Describe the distribution of minerals in Pakistan.

Copper and gold deposits occur in western Balochistan, including Saindak and Reko Diq. Rock salt is concentrated in the Salt Range around Khewra in Punjab. Coal deposits occur in several areas, notably Thar in Sindh as well as parts of Balochistan.

Examiner focus: Use geographically precise examples; avoid presenting all minerals as concentrated in one region.

[3 marks] Describe the characteristics of coal as a resource.

Coal is a combustible fossil fuel formed from ancient plant remains over geological time. It is a non-renewable resource that can provide fuel for thermal electricity generation and some industries. Coal mining and burning may create air pollution, greenhouse-gas emissions and damaged land.

Examiner focus: Properties + use + environmental limitation distinguish three features.

4-MARK QUESTIONS

[4 marks] Explain how mining contributes to economic development.

Mining creates direct jobs in extraction and processing, while demand for transport, machinery and services supports additional employment around mining areas such as Saindak. Minerals also provide raw materials or export products; copper from Balochistan, for example, can earn revenue and stimulate investment in roads and electricity if processing and transport are developed.

Examiner focus: Two developed economic channels; do not claim a project's future benefit has already been realised.

[4 marks] Explain how mining can damage the environment.

Excavation and waste dumps remove vegetation and disturb topsoil, increasing erosion and destroying habitats around the mine. Blasting, processing and disposal of waste can produce dust and polluted runoff; contaminated water may harm aquatic ecosystems and reduce water quality for nearby communities.

Examiner focus: Two linked mechanisms: land/habitat damage and pollution.

5-MARK QUESTION

[5 marks] Assess the environmental impacts of mineral extraction.

Open-cast extraction and waste disposal can remove vegetation, disturb soils and fragment habitats. In dry areas of Balochistan, this loss of sparse vegetation can make land more vulnerable to erosion and difficult to restore. Dust from crushing and transport worsens air quality, while poorly contained processing waste may pollute surface or groundwater. Mining also provides minerals needed for infrastructure and energy systems, so the environmental cost depends partly on how it is managed. Environmental impact assessment, water treatment, waste containment and restoring mined land can reduce damage, although they require investment and monitoring. The most serious impacts are those that persist after extraction, particularly contaminated water and unreclaimed land.

Examiner focus: Weigh impacts and management; the question focuses on environmental consequences, not an unrelated economic essay.

8-MARK QUESTIONS

[8 marks] "Mineral resources are essential for Pakistan's economic development." How far do you agree? Give reasons and examples to support your answer.

Minerals can contribute strongly to Pakistan's development because they supply raw materials to industry and create investment and employment. Limestone supports cement manufacture for construction, while rock salt at Khewra is used in food and chemical industries. Copper resources around Saindak and Reko Diq in Balochistan offer opportunities for processing, export earnings and associated transport and service jobs. Mining can therefore diversify economic activity in less industrialised regions.

However, the size of a deposit does not guarantee a large economic benefit. Remote deposits require expensive roads, power, water and skilled labour, and raw minerals may earn less than processed products. Poorly regulated extraction can damage water supplies and land, imposing costs on communities. Development also depends on agriculture, manufacturing, trade and services, so minerals cannot replace investment in these sectors.

Overall, mineral resources can be an important foundation for some industries and regional development, especially when value is added locally. They are not sufficient on their own: infrastructure, skills, fair distribution of benefits and environmental safeguards determine how much extraction contributes to sustainable growth.

Examiner focus: Named examples and counterarguments should address "essential," not merely list minerals.

[8 marks] Assess the sustainability of mineral extraction in Pakistan. Give reasons and examples to support your answer.

Minerals are non-renewable, so the deposits themselves cannot be replenished on a human timescale. Nevertheless, extraction can be managed more sustainably by limiting environmental damage and using revenue to improve long-term social and economic opportunities. Environmental assessments, contained tailings, treatment or recycling of process water and reclamation after closure can reduce pollution, erosion and habitat loss. Operations in dry western areas such as the Saindak and Reko Diq regions require particular care over scarce water supplies.

There are major limitations. Open-cast extraction permanently alters landscapes, and waste storage needs long-term monitoring. Roads and machinery may damage fragile dryland ecosystems, while local communities may bear the costs if jobs and revenue are not fairly shared. Poor enforcement can make written safeguards ineffective. Yet a ban on all extraction would remove inputs needed by domestic industries and potential earnings that could fund other development.

Overall, mineral extraction cannot be renewable, but its impacts and benefits can be managed more sustainably. Strong water safeguards, independent monitoring, land restoration and lasting benefits for nearby communities are more meaningful measures of success than output or export value alone.

Examiner focus: Distinguish sustainable management from replenishing finite minerals; avoid unsupported numerical claims about named projects.

C. WATER

1-MARK QUESTIONS

[1 mark] Define the term water scarcity.

A situation in which available usable water is insufficient to meet demand.

[1 mark] Name one source of freshwater in Pakistan.

The Indus River.

[1 mark] Name one use of water in Pakistan.

Irrigation of crops.

2-MARK QUESTIONS

[2 marks] State two causes of water shortage.

Low or highly variable rainfall; inefficient irrigation with seepage and evaporation losses.

[2 marks] Give two uses of water in Pakistan.

Irrigating farmland and supplying households with drinking water.

[2 marks] State two sources of water supply.

Surface water from rivers or reservoirs; groundwater extracted through wells and tube wells.

3-MARK QUESTIONS

[3 marks] Describe the sources of water supply in Pakistan.

Surface water comes mainly from the Indus and its tributaries, supplemented by rainfall and meltwater from northern snow and glaciers. Dams and reservoirs store some of this water for later use. Groundwater stored in aquifers is accessed through wells and tube wells, particularly where canal supplies are insufficient.

Examiner focus: Three sources/storage pathways; distinguish a reservoir from the original source of its water.

[3 marks] Describe seasonal changes in water availability.

River flow is generally lower in winter when northern snow and glacier melt is reduced. Rising temperatures in spring and early summer increase meltwater feeding the Indus system. Summer monsoon rainfall usually raises runoff and river discharge further, though the amounts vary strongly between years and regions.

Examiner focus: Seasonal pattern rather than a vague statement that Pakistan has shortages.

4-MARK QUESTIONS**[4 marks] Explain why Pakistan faces water shortages.**

Rainfall is uneven and often seasonal, so dry regions such as Balochistan receive too little reliable rain to meet agricultural and domestic demand. At the same time, rising urban and irrigation demand, canal seepage and inefficient water use reduce the amount of usable water available, creating shortages even where major rivers exist.

Examiner focus: Two developed lines of causation: physical supply and demand/management.

[4 marks] Explain how dams help manage water resources.

Dams store part of the high summer river flow in reservoirs and release it during drier periods, making irrigation supplies more reliable. They can also regulate discharge to reduce some downstream flood peaks, while controlled releases through turbines generate hydroelectric power, as at Tarbela; their benefits are reduced if siltation shrinks storage capacity.

Examiner focus: Develop two mechanisms relevant to water management; HEP is a linked use, not a substitute for explaining storage.

[4 marks] Explain how climate affects water supply.

Summer monsoon rainfall increases river flow and groundwater recharge, but unreliable timing and drought can leave some districts short of water. Temperature influences snow and glacier melting in northern catchments: warmer spring and summer conditions increase meltwater to the Indus, while long-term glacial retreat creates uncertainty for future supplies.

Examiner focus: Two mechanisms: rainfall variability and temperature-driven meltwater.

5-MARK QUESTIONS**[5 marks] Assess the importance of water for agriculture in Pakistan.**

Water is essential to Pakistan's irrigated agriculture because much of the Indus Plain receives insufficient or unreliable rainfall for consistent crop yields. The Indus canal network, supplied through structures such as Sukkur Barrage, supports crops including wheat, rice and cotton, sustaining farm incomes and agro-based industry. Tube wells can supplement canal supplies during dry periods. However, agriculture is vulnerable when irrigation is inefficient or groundwater is over-pumped, and waterlogging and salinity can reduce soil productivity. Water is therefore vital, but efficient distribution, drainage and suitable crops determine whether irrigation remains productive in the long term.

Examiner focus: Named infrastructure used as application, with benefits weighed against sustainability constraints.

[5 marks] Assess the causes of water shortages in Pakistan.

Low and uneven rainfall creates a basic supply problem, particularly in arid parts of Balochistan and the Thar area. More broadly, population growth, industrial demand and water-intensive irrigation increase pressure on available surface and groundwater. Leaky canals, evaporation losses, pollution and uncontrolled pumping can turn physical water availability into a shortage of usable or reliably delivered water.

Seasonal dependence on summer meltwater and monsoon rain makes storage important, yet reservoirs lose capacity through siltation. In many irrigated and urban districts, management and demand can be as important as low rainfall, while naturally arid areas face both constraints together. Examiner focus: Assess relative significance; do not make an unsupported single-cause national claim.

8-MARK QUESTIONS

[8 marks] “Water shortages are the greatest challenge facing Pakistan.” How far do you agree with this statement? Give reasons and examples to support your answer.

Water shortages affect several sectors at once. Farms in the Indus Plain need reliable canal and groundwater irrigation because rainfall is often seasonal; insufficient supply can reduce yields of wheat, cotton and other crops and raise food prices. Cities such as Karachi also need safe domestic and industrial supplies. Reduced reservoir levels can limit hydroelectric generation at facilities such as Tarbela, linking water insecurity to power supply. In arid districts of Balochistan, low rainfall and groundwater depletion make the problem especially severe.

However, calling water shortage the greatest challenge depends on the area and the measure used. Flooding can destroy homes, crops and transport networks in a short period, as seen in the 2022 floods. Energy costs, limited employment, poverty and rapid urban growth also affect development, sometimes independently of water supply. In addition, inefficient distribution, contamination and over-abstraction mean the challenge is not only the physical amount of water.

Overall, water insecurity is one of Pakistan’s most far-reaching development challenges because it affects food, health, industry and electricity together. I agree to a considerable extent, but in different regions flood risk, employment or infrastructure may create more immediate problems, and improving water management is as important as increasing supply.

Examiner focus: A defensible degree of agreement must emerge from relevant contrasting national challenges, not just a water essay.

[8 marks] Assess the effectiveness of strategies used to manage water resources in Pakistan. Give reasons and examples to support your answer.

Large dams and reservoirs can store seasonal river water for drier months, support hydropower and help regulate some flood peaks. Tarbela and Mangla are major examples. Barrages such as Sukkur divert Indus water into canal systems that supply agriculture in dry parts of Sindh. However, dams are expensive, can displace communities and lose storage capacity through siltation; unlined canals lose water through seepage and may contribute to waterlogging.

Other strategies tackle inefficient use and local supply problems. Canal lining and improved drainage can reduce losses and salinity in irrigated areas, while drip or sprinkler irrigation may use less water than traditional flood irrigation for suitable crops. Tube wells supply farms beyond canals and can lower high water tables in some areas, but excessive pumping depletes aquifers or draws up saline water. Protecting catchment forests and restoring wetlands can help manage runoff, erosion and recharge, though these measures require long-term upkeep and community involvement.

Overall, the most effective strategy is a combination: storage and controlled distribution where appropriate, coupled with water-saving irrigation, pollution control and protection of groundwater. Building more dams alone will not solve losses and rising demand across Pakistan.

Examiner focus: Compare named strategies, developed strengths and limitations, and supported contextual judgement.

A. SUSTAINABLE MANAGEMENT OF FORESTS

1-MARK QUESTIONS

[1 marks] Define the term afforestation.

Planting trees on land that previously had no forest.

[1 marks] Name one government programme to increase forest cover in Pakistan.

The Ten Billion Tree Tsunami Programme (TBTP).

2-MARK QUESTIONS

[2 marks] State two benefits of forests.

Forests reduce soil erosion by holding soil with roots; they provide timber and fuelwood for people.

[2 marks] Give two causes of deforestation in Pakistan.

Cutting trees for fuelwood; clearing forest to create farmland or settlements.

[2 marks] State two methods used to reduce deforestation.

Enforcing limits on illegal logging; supplying affordable alternatives to household fuelwood.

3-MARK QUESTIONS

[3 marks] Describe the importance of forests for the natural environment.

Forest cover protects soil from erosion because roots bind the ground. Trees intercept rainfall and slow runoff, reducing the severity of some floods. Forest habitats support biodiversity, including species adapted to coniferous forest and Indus Delta mangroves.

[3 marks] Describe the role of community forestry.

Local residents take part in protecting, monitoring and restoring nearby forests. They may plant or protect native trees and agree controlled use of timber and fuelwood. Their involvement can provide livelihood benefits and build local incentives to prevent overcutting.

[3 marks] Describe the effects of deforestation on water resources.

Loss of canopy interception makes more rain reach the ground rapidly, increasing surface runoff. Soil washed from exposed slopes can accumulate as sediment in rivers and reservoirs. Reduced infiltration on damaged land can also lower groundwater recharge and intensify dry-season shortages.

4-MARK QUESTIONS

[4 marks] Explain two ways how afforestation helps reduce environmental problems.

Afforestation reduces soil erosion because tree roots hold the soil together, while leaves and branches reduce the force of rainfall. This prevents fertile topsoil from being washed away and reduces sedimentation in rivers and reservoirs.

Afforestation also reduces climate change because trees absorb carbon dioxide during photosynthesis and store carbon. This lowers the amount of this greenhouse gas in the atmosphere and may reduce global warming.

[4 marks] Explain two ways why deforestation increases flood risk.

Deforestation removes the tree canopy that intercepts rainfall. Less water is absorbed by vegetation and infiltrates into the soil, so more water flows quickly over the surface into rivers. River levels rise rapidly, increasing the risk of flooding.

Deforestation also increases soil erosion because tree roots no longer hold the soil together. The eroded soil is deposited in rivers and reservoirs, making them shallower and reducing their capacity to hold water. As a result, they overflow more easily during heavy rainfall.

[4 marks] Explain two ways how alternative energy sources can reduce deforestation.

Solar energy, biogas and hydroelectricity can provide households with energy for cooking and heating. This reduces their dependence on fuelwood, so fewer trees are cut from nearby forests.

Alternative energy can also provide electricity to small industries that might otherwise burn wood or charcoal. Using solar, wind or hydroelectric power reduces commercial demand for forest products, allowing forests to regenerate.

5-MARK QUESTIONS

[5 marks] Assess the effectiveness of government measures to reduce deforestation.

Afforestation and protection programmes can restore cover and reduce erosion, as illustrated by the Ten Billion Tree Tsunami Programme described in the book. However, sapling totals are not a reliable measure of success unless trees survive grazing, drought and illegal felling. Forest-law enforcement can protect mature forests, but limited staff and local fuelwood dependence can weaken compliance. Providing alternative energy and involving communities deal with the demand behind cutting, though these measures need sustained investment. Long-term effectiveness therefore depends on survival and maintenance, local support and lower pressure on existing forests.

[5 marks] Assess the importance of forests for sustainable development.

Forests support environmental sustainability by stabilising soil, storing carbon and protecting habitats. Forested catchments upstream of Tarbela and Mangla can reduce erosion and sediment entering reservoirs, helping preserve water and electricity storage capacity. Mangroves in the Indus Delta protect fisheries and reduce some coastal erosion and storm impacts. Economic benefits include wood products and local jobs, but uncontrolled extraction can destroy these gains. Forest conservation is most sustainable where livelihoods and protection are planned together.

8-MARK QUESTIONS

[8 marks] "Deforestation is the main cause of environmental degradation in Pakistan." How far do you agree with this statement? Give reasons and examples to support your answer.

Deforestation contributes substantially to environmental degradation, particularly in northern watersheds. Removing tree cover reduces interception and root binding, so heavy rainfall can wash fertile soil downslope. Sediment may accumulate in reservoirs serving the Indus irrigation and hydropower systems. In the Indus Delta, loss of mangroves can weaken coastal protection and remove fish nursery habitat. These linked impacts make forest loss especially serious where steep terrain or vulnerable coasts magnify its effects.

However, environmental degradation has other major causes. Untreated industrial waste and sewage damage rivers and water supplies even where trees remain. Waterlogging and salinity can lower farm productivity in heavily irrigated parts of Sindh and Punjab, while air pollution and poor urban waste management harm growing cities. In some locations those pressures may be more immediate than forest loss.

Overall, deforestation is a major cause rather than the single main cause everywhere. Its relative significance is high in mountain catchments and mangrove areas, but managing Pakistan's environmental degradation requires coordinated forest, water, agricultural and urban measures.

Examiner focus: Develop both the claim and a meaningful alternative with distinct geographical examples. Conclude comparatively.

[8 marks] Assess the effectiveness of sustainable forestry practices in Pakistan. Give reasons and examples to support your answer.

Restoring native woodland, protecting natural regeneration and monitoring harvesting can preserve biodiversity while retaining long-term economic benefits. The Ten Billion Tree Tsunami Programme combines planting and regeneration, while the Aga Khan Rural Support Programme is described in the textbook as supporting awareness and rehabilitation in Gilgit-Baltistan. Protected upper catchments can limit sediment entering major reservoirs; managed mangrove restoration in the Indus Delta can also support fisheries and coastal protection.

These approaches have limitations. Replanting on dry or heavily grazed land may result in poor survival, and timber restrictions alone may be ignored where people cannot afford alternatives to fuelwood. Poor monitoring makes it difficult to distinguish surviving forest from announced planting totals. Community participation and suitable species therefore matter as much as the scale of a programme.

Overall, practices are effective where existing forest protection, locally suited regeneration, accessible household energy and long-term survival monitoring are combined. Judging success by tree survival, reduced erosion and community benefits gives a stronger assessment than counting trees planted.

Examiner focus: Use multiple named textbook initiatives and assess practical limitations.

[8 marks] (d) Evaluate the importance of managing forests sustainably. Use Fig. and your own knowledge.

Figure-dependent answer — the question-bank PDF describes, but does not reproduce, the referenced figure. Build the own-knowledge component from erosion, Tarbela/Mangla watershed protection, mangrove resilience and local livelihoods; add accurate evidence from the exact diagram and then assess limitations and reach a supported judgement.

Examiner focus: Do not claim to have extracted evidence from an unavailable figure. Complete source observations once the actual figure is supplied.

B. SUSTAINABLE MANAGEMENT OF MINERALS

1-MARK QUESTIONS

[1 marks] Define the term sustainable mining.

Extracting minerals while limiting environmental and social damage and managing land and resources for future needs.

[1 marks] Name one environmental problem caused by mining.

Water pollution from mine wastewater.

[1 marks] Name one method used to control pollution in mining areas.

Treating contaminated mine wastewater before discharge.

2-MARK QUESTIONS

[2 marks] State two environmental impacts of mining.

Dust and air pollution; contamination of surface or groundwater by mine waste.

[2 marks] Give two ways to reduce pollution in mining.

Treat mine wastewater before release; suppress dust by damping haul roads and covering ore loads.

[2 marks] State two methods of land reclamation.

Backfill abandoned excavation pits; restore topsoil and replant vegetation.

3-MARK QUESTIONS

[3 marks] Describe the impacts of mining on the environment.

Excavation removes vegetation and disturbs landforms and habitats. Loose waste and exposed ground can increase erosion and dust. Untreated drainage may pollute rivers and groundwater with sediments or harmful substances.

[3 marks] Describe how land can be restored after mining.

Open pits may be backfilled or graded into stable slopes. Stored topsoil can then be replaced to improve growing conditions. Suitable native plants can be replanted and the site monitored for erosion and vegetation recovery.

[3 marks] Describe the importance of monitoring mining activities.

Regular inspection checks whether mine operators control runoff, dust and waste as required. Water and air monitoring can identify pollution before it spreads. Rehabilitation checks help authorities determine whether land is being restored after extraction ends.

4-MARK QUESTIONS

[4 marks] Explain how mining affects human health.

Dust generated by blasting, crushing and mine traffic can be inhaled by workers and neighbouring residents, causing or aggravating respiratory problems. Untreated mine wastewater containing harmful contaminants can enter drinking-water sources or crops, increasing the risk of illness unless collected and treated.

[4 marks] Explain how land reclamation improves sustainability.

Replacing topsoil and replanting a closed mine reduces bare ground, erosion and the spread of sediment to nearby watercourses. Stable slopes and recovered habitats make land safer and potentially useful again for grazing or other livelihoods, reducing long-lasting damage after mineral extraction stops.

5-MARK QUESTIONS

[5 marks] Assess the environmental impacts of mining in Pakistan.

Copper and gold extraction at Saindak and the Reko Diq area can support economic development, but open-pit excavation disturbs large areas of land and creates waste rock. Dust from extraction and haulage can affect air quality, while poorly managed wastewater and tailings could threaten scarce water supplies, particularly in arid Balochistan. The severity depends on mine design, monitoring and waste treatment: a regulated site with tailings containment and rehabilitation need not cause the same damage as poorly managed extraction. Overall, water protection, waste management and eventual site restoration are essential where water is already limited.

[5 marks] Assess the importance of sustainable mining practices.

Sustainable mining is important because extraction can create jobs and supply domestic industries, but damaged land and polluted water impose long-term costs. Water-efficient processing, controlled tailings storage and wastewater treatment are particularly important in arid mineral-producing regions such as Chagai, Balochistan. Reclamation can restore land after extraction; however, these measures require ongoing monitoring and may be costly for operators. Their importance lies in preserving economic gains without leaving communities with avoidable environmental harm.

8-MARK QUESTIONS

[8 marks] “Mining activities cause more harm than benefit in Pakistan.” How far do you agree with this statement? Give reasons and examples to support your answer.

Mining can damage fragile environments. Large-scale excavation removes vegetation and creates waste rock, while dust and inadequately controlled mine drainage can affect workers and neighbouring settlements. This is especially important in arid Chagai, where copper and gold projects such as Saindak and Reko Diq operate in landscapes with limited water. Rehabilitation is difficult where soil and rainfall are scarce.

There are also significant benefits. Minerals supply industry, provide employment and can generate tax revenue and export earnings. Rock salt at Khewra supports extraction and tourism; limestone and gypsum support Pakistan’s cement and construction sectors. Infrastructure constructed for mines may also improve access to remote areas, although those benefits depend on links to local communities.

Overall, whether harm outweighs benefit depends largely on environmental safeguards and how revenue is used. Regulated extraction, wastewater treatment, secure waste storage, reclamation and local benefits make a stronger case for mining than extraction without these protections.

Examiner focus: Balance benefits and harms with named, correctly located examples.

[8 marks] Assess the effectiveness of strategies used to reduce environmental damage from mining. Give reasons and examples to support your answer.

Treating mine wastewater and securely storing tailings can limit contamination of streams and groundwater. These controls matter particularly in arid mining districts such as Chagai, where polluted groundwater would be difficult to replace. Dust suppression and covered transport reduce airborne particles, while planned reclamation and native planting can stabilise disturbed sites once mining stops. Environmental assessment and inspections can identify local risks early.

However, treatment and monitoring require specialist staff, funding and enforcement. In dry regions, restoration is slow, and some open-pit impacts cannot be completely reversed. Poorly maintained tailings facilities remain a serious risk even if a mine has a written environmental plan.

Overall, the strongest approach is preventive design combined with enforceable monitoring throughout the mine’s life and funded restoration after closure. Effectiveness should be judged by measured water quality, dust exposure and restored land rather than promises alone.

Examiner focus: Support a judgement with limitations and realistic measures of success.

C. SUSTAINABLE MANAGEMENT OF WATER

1-MARK QUESTIONS

[1 marks] Define the term water security.

Reliable access to sufficient safe water for domestic use, agriculture and industry.

[1 marks] Name one major dam in Pakistan.

Tarbela Dam.

[1 marks] Name one problem caused by irrigation.

Waterlogging.

2-MARK QUESTIONS

[2 marks] State two uses of dams.

Storing water for irrigation; generating hydroelectric power.

[2 marks] Give two causes of water shortages.

Irregular rainfall and drought; excessive withdrawals and water lost from inefficient irrigation systems.

3-MARK QUESTIONS

[3 marks] Describe the importance of dams.

Reservoirs store wet-season river water for release during dry periods. Dams can supply water to irrigation systems that support the Indus Plain's agriculture. Hydroelectric stations at dams such as Tarbela also generate electricity.

[3 marks] Describe the impacts of barrages on agriculture.

Barrages divert river water into canals, extending irrigation to farmland away from natural river channels. More reliable water supply enables crops to be grown where rainfall is insufficient. Poorly managed canals can also cause seepage, waterlogging and salinity.

[3 marks] Describe problems in irrigation systems.

Seepage from unlined canals wastes water and can raise the local water table. Waterlogged soils reduce root aeration, and evaporation may leave salts near the surface. Upstream overuse and inequitable deliveries can leave tail-end farms with insufficient water.

4-MARK QUESTIONS

[4 marks] Explain how dams help economic development.

Stored water released from dams such as Tarbela helps maintain canal irrigation during drier periods, supporting crop yields and agro-based industries. Hydroelectric turbines also generate power for households and factories, potentially reducing the economic disruption caused by electricity shortages.

[4 marks] Explain why irrigation systems can be inefficient.

Unlined canals and watercourses can lose substantial water through seepage before it reaches fields, while damaged channels may leak or spill. Poor scheduling and excessive flood irrigation can apply more water than crops need, raising groundwater levels and increasing waterlogging rather than improving yields.

[4 marks] Explain how waterlogging and salinity occur.

Continuous or excessive canal irrigation and seepage can raise the groundwater table until soil pores fill with water, depriving plant roots of oxygen: waterlogging. Where groundwater contains dissolved salts, capillary movement and intense evaporation draw salt towards the soil surface, causing salinity and reducing crop growth.

5-MARK QUESTIONS

[5 marks] Assess the importance of irrigation in Pakistan.

Irrigation is vital in much of the Indus Plain because rainfall is insufficient or unreliable for intensive cropping. Canals supplied by Indus water support wheat, cotton, rice and sugarcane production and provide raw materials for food processing and textiles. Yet seepage, inequitable distribution, waterlogging and salinity reduce these benefits, especially where drainage is poor. Improved lining, scheduling and drainage are therefore important to sustain irrigation's economic value.

8-MARK QUESTIONS

[8 marks] "Dams are the best solution to water shortages in Pakistan." How far do you agree with this statement? Give reasons and examples to support your answer.

Dams provide major benefits by storing high river flows for release during dry periods. Tarbela and Mangla support the Indus irrigation system, while hydropower generation brings additional economic value. Storage can reduce vulnerability to seasonal variations in snowmelt and rainfall and help supply towns and industry.

However, reservoirs are costly and can displace communities, trap sediment and disturb downstream ecosystems. Their capacity may decline through siltation, and additional storage alone cannot solve leaks, polluted water, wasteful irrigation or uneven access. Canal lining, improved drainage, water-efficient application and sewage treatment may save or protect water already available. In the Indus Delta, maintaining suitable downstream flows also matters for coastal ecosystems.

Overall, dams are an important part of the solution, especially for seasonal storage, but the most sustainable approach combines storage with demand management, improved irrigation efficiency, water-quality protection and environmental safeguards.

Examiner focus: Avoid asserting dams are always best: the highest levels require alternative considerations and a supported view.

[8 marks] Assess the effectiveness of sustainable irrigation methods in Pakistan. Give reasons and examples to support your answer.

Lining canals and watercourses can reduce seepage losses, delivering more of the diverted Indus water to fields. More precise irrigation scheduling and drip or sprinkler systems can reduce unnecessary application, while drainage and appropriately managed tube wells may limit waterlogging in some affected areas. These measures can help sustain crop production when supplies are variable.

Yet lining large canal systems is expensive; drip systems need capital, maintenance and reliable access to parts, and indiscriminate groundwater pumping can deplete or salinise aquifers. Methods must therefore be selected for crop type, soil and local water conditions rather than applied everywhere without adaptation.

Overall, targeted combinations of better maintenance, efficient application and drainage are effective when farmers can afford them and agencies monitor both yields and water-table impacts.

Examiner focus: Use evidence of both effectiveness and constraints; name Indus Basin and local soil/water conditions.

D. WATER POLLUTION AND WATER SECURITY

1-MARK QUESTIONS

[1 marks] Name one source of water pollution.

Untreated industrial wastewater.

[1 marks] Name one method of reducing pollution.

Treating municipal sewage before it enters rivers.

2-MARK QUESTIONS

[2 marks] State two causes of water pollution.

Discharge of untreated domestic sewage; release of untreated industrial effluent.

[2 marks] Give two ways to reduce water pollution.

Expand wastewater treatment; monitor and enforce limits on industrial discharge.

[2 marks] State two impacts of polluted water.

Increased risk of waterborne disease; reduced usable water for households or irrigation.

3-MARK QUESTIONS

[3 marks] Describe the importance of water security.

Reliable clean drinking water protects health and daily life. Secure irrigation supplies support farming and food production in Pakistan's dry and semi-arid regions. Industry and electricity generation also depend on dependable supplies, making water shortages an economic problem.

[3 marks] Describe the impacts of pollution on water supply.

Untreated sewage can make river and groundwater unsafe to drink without treatment. Industrial contaminants may increase water-treatment costs or render some sources unusable. Reduced access to clean water increases pressure on remaining wells, canals and piped systems.

4-MARK QUESTIONS

[4 marks] Explain how industrial pollution affects water quality.

Factories may discharge untreated chemicals, oils or other harmful substances into watercourses, increasing toxic contamination and making water unsafe for people or irrigation. Organic industrial effluent can also lower dissolved oxygen as it decomposes, harming aquatic organisms and reducing river-water quality.

[4 marks] Explain how sewage treatment improves water quality.

Primary and secondary sewage treatment removes solids and breaks down much organic waste before wastewater reaches rivers, reducing oxygen demand and pollution. Disinfection can then reduce disease-causing microorganisms, lowering health risks for communities using downstream water, although treatment must be maintained and monitored.

5-MARK QUESTIONS

[5 marks] Assess the causes of water pollution in Pakistan.

Untreated domestic sewage from growing towns is a widespread cause because sewerage and treatment capacity often lag urban expansion. Industrial effluent from manufacturing centres can add chemical pollution to rivers, while farm runoff carries fertilisers and pesticides into canals and drains. The relative severity differs: sewage can dominate microbial contamination near settlements, whereas local industrial discharge may be more dangerous for particular chemicals. Effective control therefore requires sector-specific treatment and enforcement rather than one universal remedy.

8-MARK QUESTIONS

[8 marks] “Water pollution is the main threat to water security in Pakistan.” How far do you agree with this statement? Give reasons and examples to support your answer.

Water pollution is a major threat because supply is only useful if it is safe. Untreated urban sewage and industrial effluent can contaminate surface water and groundwater, raising treatment costs and exposing households to illness. In cities such as Karachi, rapid growth can increase the challenge of supplying and treating water consistently. Agricultural runoff may further degrade canals and drains.

However, insufficient quantity is also critical. Seasonal rainfall, drought, variable river flows, leaking canals, over-extraction and growing domestic and agricultural demand can leave even relatively clean supplies inadequate. Inefficient irrigation in the Indus Basin can waste large quantities of water, while excessive pumping may threaten groundwater availability.

Overall, pollution is particularly serious for safe domestic supply, but scarcity and mismanagement are equally important in many farming districts. Water security needs a combined approach: wastewater treatment, pollution enforcement, demand control, maintenance and sustainable groundwater use.

Examiner focus: Compare quality and quantity threats, with named urban and irrigation contexts.

[8 marks] Assess the effectiveness of methods used to improve water security in Pakistan. Give reasons and examples to support your answer.

Reservoir storage at Tarbela and Mangla and distribution through the Indus irrigation system help farmers cope with seasonal fluctuations. Lining canals and scheduling irrigation reduce avoidable losses, while sewage treatment and industrial effluent controls increase the quantity of water that is safe to use. Groundwater recharge and wetland restoration in projects such as Recharge Pakistan can also support water availability in some floodplain areas.

Nevertheless, reservoirs require costly maintenance and face siltation, efficiency upgrades need funding and farmer cooperation, and treatment works fail without continuous operation and enforcement. Groundwater extraction must also remain within sustainable recharge.

Overall, methods are most effective as a linked system: protect water quality, reduce demand and waste, store seasonal flows, and monitor groundwater and environmental effects. Judge performance by reliable safe supply, not merely installed infrastructure.

Examiner focus: Draw from distinct management methods in the textbook and acknowledge limits.

A. WEATHER, CLIMATE AND DATA

[1 mark] Define the term weather.

The day-to-day atmospheric conditions at a particular place and time.

[1 mark] Define the term climate.

The long-term average pattern of weather in a place, usually calculated over about 30 years.

[1 mark] State one element of weather.

Air temperature.

[2 marks] State two differences between weather and climate.

Weather describes conditions at a particular time whereas climate describes averages and patterns over many years. Weather can change from hour to hour whereas climate is assessed using long-term records.

[2 marks] State two types of precipitation.

Rain and snow.

[3 marks] Describe how mean daily temperature is calculated.

Record temperatures throughout the day at regular intervals. Add the readings together. Divide the total by the number of readings to find the mean daily temperature.

[3 marks] Describe how temperature range is calculated.

Identify the highest temperature in the period. Identify the lowest temperature in the same period. Subtract the lowest from the highest to obtain the range in °C.

[4 marks] Explain how temperature data can be used to describe climate.

Long-term monthly temperature averages reveal the usual seasonal pattern: for example, they show whether summers are much hotter than winters. Calculating the annual temperature range reveals how extreme the contrast is, allowing comparison between inland cities such as Sukkur and higher-altitude locations such as Murree.

[5 marks] Assess the usefulness of climate data in understanding weather patterns.

Climate data show recurring seasonal trends, such as hot summers and monsoon rainfall, helping farmers plan sowing and authorities anticipate high-risk periods. Long-term records also help identify unusual heat or rainfall against the historical average. However, regional averages can conceal local differences, especially between mountains and plains; historical data cannot specify the exact timing of an individual storm. Therefore, climate data are valuable for identifying likely patterns and risk but must be combined with current observations and forecasts for day-to-day decisions.

[8 marks] "Temperature data alone is sufficient to describe the climate of a region." How far do you agree? Give reasons and examples.

Temperature is essential because monthly averages and the annual range distinguish places with hot summers and mild winters from places with colder conditions. For example, Sukkur has much hotter summers than high-altitude Murree; their temperature records help explain differences in heating demand, cropping and tourism. However, temperature alone does not describe moisture.

Monsoon rainfall affects crop water supplies and flood risk in northern Punjab, while the dryness of parts of Balochistan constrains rain-fed farming. Humidity, wind, cloud cover and extreme events also affect human activity: coastal Karachi feels different from equally warm inland areas because the Arabian Sea moderates temperature and contributes moisture. Two places with similar average temperatures may therefore have very different water availability and risks. Overall, temperature data are indispensable but insufficient on their own; rainfall and other atmospheric measurements are needed for an accurate account of a region's climate.

B. TEMPERATURE

[1 mark] Define temperature range.

The difference between the highest and lowest recorded temperatures over a stated period.

[1 mark] Define annual average temperature.

The mean temperature over an entire year, generally calculated from the 12 monthly mean temperatures.

[2 marks] State two characteristics of hot climates.

High daytime temperatures for much of the year; often a long, intensely hot summer.

[2 marks] Name two areas with very high temperatures.

Sibi and Jacobabad.

[3 marks] Describe the distribution of temperature categories in Pakistan.

The lowland interior, including parts of Sindh and southern Punjab, experiences very high summer temperatures. Coastal areas have more moderate temperatures under maritime influence. Northern mountains, particularly at high altitude, are cooler and can have freezing winter temperatures.

[3 marks] Describe the characteristics of very hot regions.

They often record summer daytime temperatures above 40°C; hot weather persists for long periods in late spring and summer; and inland locations tend to have a greater seasonal temperature range than coastal areas.

[4 marks] Explain why some areas experience very high temperatures.

Low-lying interior areas such as Jacobabad become very hot because air warms as it descends toward lower elevations and there is less cooling from altitude. They are also distant from the moderating influence of the sea, so intense summer sunshine heats the land and near-surface air strongly.

[4 marks] Explain differences between hot and cold regions.

Low-altitude southern inland regions such as Sibi are generally hotter because temperatures decrease with increasing elevation, whereas higher Himalayan and Karakoram settlements experience cooler conditions. Inland districts also heat more strongly in summer because they lack maritime moderation, while areas near the Arabian Sea have smaller seasonal ranges.

[8 marks] "Temperature variation is mainly due to physical factors." How far do you agree? Give reasons and examples.

Physical factors account for major temperature contrasts in Pakistan. Altitude explains why Murree and other northern highland settlements are substantially cooler than the Indus Plain, because air temperature generally decreases with height. Latitude and seasonal solar angle affect incoming energy, while distance from the Arabian Sea explains why Karachi has a smaller annual temperature range than inland Sukkur. Relief also influences exposure, local winds and the distribution of sunshine. However, human activity can modify temperature locally. Closely built urban areas retain

heat in roads and concrete; the urban heat-island effect can raise night-time temperatures compared with nearby rural land. Deforestation and the replacement of vegetation also reduce shading and evaporative cooling. These human influences matter especially within cities and locally altered landscapes, but they do not fully explain the large differences between northern mountains, inland plains and the coast. On balance, physical factors dominate regional temperature patterns; human influences can intensify heat at the local scale.

C. RAINFALL AND CLIMATE TYPE

[1 mark] Define arid climate.

A climate with very little precipitation, generally too little to support dense natural vegetation without adaptation.

[1 mark] Define humid climate.

A climate characterised by high atmospheric moisture, often accompanied by relatively plentiful rainfall.

[1 mark] State one rainfall category.

Arid.

[2 marks] State two characteristics of arid regions.

Low and unreliable rainfall; high potential evapotranspiration often exceeds precipitation.

[2 marks] Give two areas with high rainfall.

Murree and the foothills around Islamabad.

[3 marks] Describe rainfall distribution in Pakistan.

Rainfall is generally greater in the northern and north-eastern uplands, including Murree, than in much of the south and west. Much of Balochistan and interior Sindh receives low rainfall. The timing also varies, with strong summer monsoon influence in many eastern and north-eastern areas and more winter western-disturbance rainfall in parts of the west and north.

[3 marks] Describe characteristics of semi-arid regions.

Rainfall is low to moderate and often irregular; droughts and seasonal water shortages occur; sparse grass or scrub vegetation is more common than dense moisture-demanding forest.

[4 marks] Explain why rainfall varies across Pakistan.

Summer monsoon winds bring moisture from the Arabian Sea and Bay of Bengal, producing heavier rainfall in many north-eastern and eastern areas. Mountain barriers force moist air to rise and cool, causing orographic rainfall on windward slopes, while rain-shadow effects leave some western and interior regions comparatively dry.

[4 marks] Explain the impact of low rainfall on human activities.

Low rainfall reduces soil moisture and crop growth, so farmers may depend on irrigation and face lower yields in drought years. It also limits reliable drinking and industrial water, increasing the cost of storing, pumping or transporting supplies and influencing where settlements develop.

[5 marks] Assess the importance of rainfall for agriculture.

Rainfall replenishes soil moisture and provides water for rain-fed farming, especially in northern Punjab; adequate seasonal rain can improve wheat or fodder yields and reduce irrigation demand. Yet excessive monsoon rain can waterlog fields, destroy crops and interrupt harvests, while unpredictable rainfall exposes farmers to drought. Much of Pakistan's intensive production, including crops in the Indus Plain, also depends heavily on canal and groundwater irrigation rather than rainfall alone. Rainfall is therefore important both directly and through river recharge, but its value depends on timing, amount and how efficiently additional water is managed.

[8 marks] “Rainfall is the most important factor affecting climate in Pakistan.” How far do you agree? Give reasons and examples.

Rainfall is a major way to distinguish Pakistan’s regional climates. The relatively wet northern and north-eastern slopes support different vegetation and agricultural opportunities from the arid parts of Balochistan, where low and unreliable rainfall constrains rain-fed farming. The summer monsoon and winter western disturbances also cause marked seasonal contrasts and influence flood and drought risk. However, temperature matters just as much to many climate comparisons. Highland areas are cooler because of altitude, while lowland interior areas such as Sibi can experience extremely hot summers. Distance from the sea moderates Karachi’s temperatures even though its rainfall is relatively limited. These factors shape evaporation, vegetation, human comfort and the effectiveness of available rainfall. In addition, wind systems and relief determine where rain falls rather than rainfall being an independent cause of every climate difference. Overall, rainfall is essential for describing moisture availability and seasonality, but altitude, temperature and atmospheric circulation are also necessary; no single factor adequately explains the whole country.

Rainfall-table source set — actual figure required

The uploaded question bank states what the resource shows but does not reproduce its underlying values/symbols. The following responses distinguish what is certain from what must be taken from the original resource. Do not present illustrative values as data from the absent figure.

[1 mark] (a) Identify one extremely arid area.

The question bank does not supply its rainfall table, so the figure-specific answer cannot be verified. Nok Kundi is a relevant extremely dry Pakistani location if it appears with the lowest category in the original table.

[3 marks] (b) Describe rainfall patterns shown.

Use the actual table to state the wettest and driest location(s), quantify at least one appropriate contrast with the recorded units, and describe how rainfall changes between the listed regions.

[4 marks] (c) Explain why rainfall is low in some regions.

Low-rainfall regions far from the core summer monsoon receive less moisture, limiting precipitation. Some also lie in the rain shadow of uplands, where air has lost moisture on windward slopes, further reducing rainfall.

[8 marks] (d) Evaluate the impact of rainfall distribution on development.

Where rainfall is higher and reasonably reliable, rain-fed agriculture and natural vegetation can develop with less irrigation, potentially supporting rural livelihoods and lowering water-supply costs. In very dry areas such as much of western Balochistan, shortages constrain farming and may increase spending on boreholes, canals or water transport. Yet high rainfall is not always beneficial: intense monsoon downpours can flood roads, housing and fields, especially where drainage is inadequate. Conversely, arid areas can support development through groundwater, irrigation, minerals or services if water is managed sustainably. Rainfall distribution is therefore a major influence on the costs and risks of development but is not decisive on its own; infrastructure, irrigation, local relief and flood preparedness determine whether water becomes an opportunity or hazard. Specific categories and comparisons must be drawn from the original table before final marking.

D. CLIMATIC ZONES

[1 mark] Name one climatic zone in Pakistan.

Highland climate.

[1 mark] State one factor affecting climatic zones.

Altitude.

[2 marks] State two characteristics of highland climate.

Cool summers and cold winters; snowfall can occur in winter at higher elevations.

[2 marks] Name two areas in the arid zone.

Chagai District and the Kharan Desert in Balochistan.

[3 marks] Describe the characteristics of coastal climate.

Coastal areas such as Karachi have more moderate seasonal temperatures than inland areas because of the sea; humidity is often comparatively high; and sea breezes can influence daily temperatures and weather.

[3 marks] Describe the distribution of lowland climate.

It extends across much of the low-lying Indus Plain, including large parts of Punjab and Sindh. The southern and interior lowlands have hot summers. Conditions vary from relatively wetter north-eastern lowlands to much drier southern and western lowlands.

[4 marks] Explain why highland areas are cooler.

Air pressure is lower with increasing altitude, so rising air expands and cools, giving northern mountain settlements lower temperatures than low-lying plains. Highland sites may also experience greater snow cover and colder winter conditions, reinforcing local seasonal contrasts.

[4 marks] Explain differences between arid and coastal climates.

Arid interior areas such as Chagai have low precipitation and often strong temperature extremes because air and land heat and cool with limited maritime influence. Coastal Karachi has smaller seasonal temperature variation because the sea warms and cools more slowly than land, while onshore airflow often increases humidity.

[5 marks] Assess the importance of climatic zones in Pakistan.

Climatic zones reveal contrasts in temperature, rainfall and growing conditions, helping people choose appropriate crops, building designs and water-management methods. Highland, arid and coastal conditions also affect transport reliability, heating and cooling needs, and exposure to snow, drought or cyclones. However, broad zone boundaries can hide local differences arising from valley relief, altitude and urban development. Seasonal anomalies such as unusually strong monsoon events are also not captured by a static map. Thus, zones are a useful planning framework but should be supplemented with local and seasonal climate data.

[8 marks] "Altitude is the most important factor affecting climatic zones." How far do you agree? Give reasons and examples.

Altitude strongly affects Pakistan's climate, particularly in the north. Murree and high mountain settlements are cooler than the lowland Indus Plain because temperature generally falls with height; some upland locations receive snowfall while southern plains remain warm. Relief also modifies rainfall by lifting moist air on windward slopes and creating dry rain-shadow areas. Nevertheless, climatic zones also reflect latitude, proximity to the Arabian Sea and the movement of weather systems. Karachi experiences maritime moderation, while the dry west receives comparatively little summer monsoon moisture; these differences cannot be explained by altitude alone. In eastern and north-eastern Pakistan, the extent and timing of monsoon winds have a large influence on seasonal rainfall. Therefore, altitude is especially important for the highland climate and local temperature variation, but maritime influence and rainfall-bearing winds are equally necessary to explain Pakistan's complete pattern of climatic zones.

Climatic-zones map source set — actual figure required

The uploaded question bank states what the resource shows but does not reproduce its underlying values/symbols. The following responses distinguish what is certain from what must be taken from the original resource. Do not present illustrative values as data from the absent figure.

[1 mark] (a) Identify one coastal region.

Sindh coast (for example, Karachi), provided it is included in the missing map's coastal category.

[3 marks] (b) Describe the distribution of climatic zones.

Using the actual map, identify where the highland zone is concentrated, locate lowland/arid areas and describe the coastal belt; refer to the map's precise legend names rather than assuming they match generic categories.

[4 marks] (c) Explain why these zones differ.

Upland areas are cooler because temperatures fall with altitude, while coastal areas have smaller temperature ranges due to maritime moderation. Differences in monsoon reach and orographic uplift also affect rainfall across the zones.

[8 marks] (d) Evaluate how useful the map is for understanding climate patterns.

A climatic-zones map is useful for locating major regional contrasts and allowing teachers, planners and students to connect broad conditions with relief, settlements and agriculture. It can show, for instance, the highland north, broad lowlands and coastal belt if these are the categories used in the original map. However, the map represents categories rather than exact measured values; rainfall, humidity and seasonal temperature range can differ greatly inside one large zone. Zone boundaries are also necessarily simplified, especially in complex mountain valleys and rapidly changing built-up areas. The map is therefore an effective national overview but cannot replace local temperature and rainfall graphs or evidence of extreme events. A precise answer would add at least two examples from the map's actual legend and distribution.

E. FACTORS AFFECTING TEMPERATURE

[1 mark] Define latitude.

The angular distance of a place north or south of the Equator, measured in degrees.

[1 mark] Define altitude.

The height of a place above mean sea level.

[1 mark] Define continental effect.

The greater seasonal temperature extremes experienced inland, far from the sea's moderating influence.

[2 marks] State two effects of latitude on temperature.

Places at lower latitudes generally receive more direct sunlight and are warmer; at higher latitudes, lower solar angles generally reduce the energy received per unit area.

[2 marks] Give two effects of altitude.

Air temperature generally falls as altitude increases; high places are more likely to experience winter frost and snowfall.

[4 marks] Explain how latitude affects temperature in Pakistan.

Southern Pakistan is closer to the Equator, so the Sun's rays tend to strike more directly and deliver more energy per unit surface area. Northern Pakistan lies at a higher latitude and receives less direct winter sunlight, contributing to lower temperatures, although altitude also strongly affects the observed differences.

[4 marks] Explain how maritime influence affects coastal climates.

Seawater warms and cools more slowly than land, reducing temperature extremes at nearby coastal locations. In summer onshore breezes can bring relatively cooler marine air, while in winter the sea releases stored heat, making temperatures less extreme than in many inland places.

[5 marks] Assess the importance of altitude in controlling temperature.

Altitude is a strong control on temperature: cool northern highlands contrast with the hot low-lying Indus Plain because the atmosphere cools with increasing elevation. This helps explain contrasting growing seasons, heating needs and winter snowfall. However, two locations at similar height can still differ because of latitude, distance from the sea, prevailing winds and cloud cover. Altitude therefore explains major upland–lowland contrasts, but it must be considered alongside other controls to account for temperature differences across Pakistan.

[8 marks] “Distance from the sea is the main factor affecting temperature in Pakistan.” How far do you agree? Give reasons and examples.

Distance from the sea is important because the Arabian Sea heats and cools more slowly than land. Karachi consequently has more moderate seasonal temperatures than many inland cities, and sea breezes can lower daytime coastal heat. Further inland, Sukkur lacks the same strong maritime moderation and can experience greater summer heat. However, altitude is crucial nationally: mountain locations such as Murree remain much cooler than lowland settlements because temperature declines with elevation. Latitude and seasonal changes in solar radiation also help explain the contrast between northern and southern Pakistan, especially in winter. Local relief, cloud cover and urban heat can create further variation. Therefore, distance from the sea is a major control near the coast and contributes to inland continentality, but altitude is often more influential in explaining the largest countrywide contrasts; several interacting factors determine temperature patterns.

F. COMPARISON AND DATA INTERPRETATION

[1 mark] Name one hotter location shown.

Sukkur is generally hotter than Murree, but confirm the label and period on the specific source.

[1 mark] Name one cooler location shown.

Murree, subject to confirmation against the original source.

[2 marks] State two differences between Sukkur and Murree.

Sukkur has much hotter summers, whereas Murree has cooler summer conditions. Murree experiences substantially colder winters, while Sukkur generally remains milder in winter.

[3 marks] Describe differences in climate between Sukkur and Murree.

Sukkur's summers are very hot and its annual temperature range is generally greater. Murree has markedly cooler summers and cold winters, with snowfall possible. Murree is also generally wetter than Sukkur because of its highland location and exposure to rainfall-bearing weather systems.

[4 marks] Explain why Sukkur is hotter than Murree.

Sukkur lies in the low-lying Indus Plain, whereas Murree is at a much higher altitude where air temperatures are lower. Sukkur also experiences intense summer heating away from strong coastal moderation; Murree's elevated terrain and more frequent cloud and precipitation can further limit daytime heating.

[5 marks] Assess the importance of physical factors in explaining these differences.

The altitude contrast is fundamental: high-elevation Murree is cooler than lowland Sukkur. Differences in rainfall-bearing winds, cloudiness and exposure to the monsoon and western disturbances contribute to their different moisture regimes. Sukkur's inland lowland position also

intensifies summer heat. Yet exact daily conditions still depend on seasonal weather systems and local land use. Overall, physical geography explains the persistent regional contrast, while short-term weather determines particular daily differences.

[8 marks] "Altitude is the main reason for temperature differences in Pakistan." How far do you agree? Give reasons and examples.

Altitude explains an important share of Pakistan's regional temperature differences. Murree and other northern highland areas are cooler than low-lying Sukkur because rising air cools as pressure decreases at higher elevations. Even in summer, highland settlements tend to avoid the extreme heat of the southern interior; winter snowfall reinforces the contrast in some northern locations. However, altitude does not explain all differences among lowland places. Karachi has a smaller annual range than inland Sukkur because the Arabian Sea moderates temperatures. Latitude and the seasonal angle of sunlight also affect the amount of heating received, while cloud cover and weather systems modify local conditions. Cities may have additional warming because built surfaces store heat. In conclusion, altitude is especially powerful when comparing the mountains with the plains, but distance from the sea and other physical controls are also needed to explain temperature differences within and across Pakistan.

Winter-temperature map source set — actual figure required

The uploaded question bank states what the resource shows but does not reproduce its underlying values/symbols. The following responses distinguish what is certain from what must be taken from the original resource. Do not present illustrative values as data from the absent figure.

[1 mark] (a) Identify one area with temperatures below 10°C.

Murree or another northern upland may qualify, but the original winter-temperature map must confirm the category and value.

[3 marks] (b) Describe the distribution of winter temperatures.

Read the actual legend and describe the broad north/south or highland/lowland contrast, identify where the coldest category is located, and add one named location or temperature band shown by the map.

[4 marks] (c) Explain why temperatures vary across Pakistan.

Northern highlands are cooler because temperature generally decreases with altitude, while southern lowlands often receive stronger winter solar heating at lower latitudes. Coastal locations also experience maritime moderation because the sea retains and releases heat more gradually than land.

[8 marks] (d) Evaluate the usefulness of the map in understanding climate.

A winter-temperature map reveals the geographical distribution of seasonal cold, helping users compare mountain, plain and coastal areas. Its named places and temperature bands can support decisions about transport, heating, frost risk and winter tourism. Nevertheless, it represents one season or time period and cannot by itself describe summer heat, annual temperature range, precipitation or extreme events. Broad temperature classes may also hide sharp variations with elevation, particularly in narrow mountain valleys. It is therefore helpful for describing winter temperature contrasts but incomplete as an account of Pakistan's overall climate. A strong answer would use at least two accurate examples and temperature categories taken directly from the original map, which is not reproduced in the question bank.

A-CAUSES OF MONSOON WINDS

[1 mark] What is a monsoon?

A seasonal wind system that reverses direction between summer and winter.

[1 mark] State the direction of the primary summer monsoon.

Generally from the south-west, carrying moisture from the Arabian Sea towards Pakistan.

[2 marks] Give two differences between primary and secondary monsoon winds.

Primary summer monsoon winds generally approach from the south-west and carry Arabian Sea moisture; the secondary branch approaches from the east/south-east after crossing India and can deliver moisture to eastern Pakistan.

[3 marks] Describe how the summer monsoon develops.

Summer heating creates low pressure over the Asian landmass while the Indian Ocean remains relatively higher-pressure. Moist maritime air moves inland from the Arabian Sea and Bay of Bengal. The air rises over heated land or mountains, cools and condenses to produce rain.

[4 marks] Explain why monsoon rainfall decreases inland.

Moist monsoon air releases rain as it rises over the north-east and foothills, losing moisture as it travels inland. Western and south-western Pakistan are farther from the main moisture-bearing tracks and mountains can create rain-shadow conditions.

[5 marks] Assess the importance of monsoon winds in controlling rainfall in Pakistan.

Monsoon winds supply much of the summer rainfall needed for crops and river recharge, especially in north-east Punjab and adjoining hills. Their strength and track influence annual rainfall variability. However, western depressions supply important winter rain and snow, particularly in the north and west. Monsoon influence is strongest in the summer and is not the only control on Pakistan's rainfall.

[8 marks] 'Monsoon winds are the main cause of rainfall in Pakistan.' How far do you agree? Give reasons and examples.

Monsoon winds are a major cause of Pakistan's summer rainfall: moist winds reach north-eastern Pakistan, producing rain that supports Kharif crops and river flows. Their concentration can also cause destructive flooding, as in Sindh during 2022. However, western depressions bring winter rain to the Potohar Plateau and snowfall to northern mountains, supporting Rabi crops and later snowmelt. Relief and distance from moisture also affect rainfall; western Balochistan remains dry despite summer monsoons. Monsoons are central to the summer rainfall regime, but it would be inaccurate to call them the sole or universal cause of rainfall across Pakistan.

[3 marks] (b) Describe the pattern of monsoon winds affecting Pakistan.

If the missing map shows the usual summer pattern, south-westerly winds travel from the Arabian Sea towards Sindh and Punjab, while an easterly branch from the Bay of Bengal can reach Punjab and the north-east. Exact arrows and areas must be checked on the supplied map.

[8 marks] d) Evaluate the importance of monsoon rainfall for Pakistan.

Monsoon rainfall replenishes rivers and supports Kharif crops, particularly rice, and can improve groundwater recharge. Yet prolonged heavy downpours cause flood deaths, crop losses and damage

to settlements, as seen in Sindh in 2022. Its geographic distribution is unequal: humid north-eastern areas generally benefit more consistently, while arid western regions receive much less. Water storage, early warning and well-managed drainage can increase the benefits and reduce the damage. Monsoon rainfall is therefore indispensable to much of Pakistan's agriculture, but its usefulness depends strongly on timing, intensity and flood preparedness.

B-CAUSES OF WESTERN DEPRESSION

[1 mark] State the source of western depressions.

They generally originate over the Mediterranean region and travel eastwards towards Pakistan.

[2 marks] State two characteristics of western depressions.

They are eastward-moving low-pressure systems associated with westerly winds; they chiefly bring winter and spring precipitation to northern and western Pakistan.

[3 marks] Describe how western depressions develop.

Low-pressure disturbances form around the Mediterranean and move east within the mid-latitude westerlies. They carry moisture across the Middle East towards Pakistan. As air rises over the north-western and northern uplands it cools and produces rain or snow.

[4 marks] Explain why western depressions bring rainfall to northern areas.

Western depressions transport moist air into Pakistan during winter when monsoon rainfall is limited. Air is forced to rise against northern mountains, cooling and condensing into rain at lower elevations and snow at higher elevations.

[5 marks] Assess the importance of western depressions for Pakistan's climate.

Western depressions provide important winter rainfall for rain-fed Rabi wheat on the Potohar Plateau and in northern Punjab. They also deposit snow in northern mountains, contributing to later snowmelt. However, they do not replace the summer monsoon, which provides much of the summer rainfall in the north-east. Their importance is especially high in winter and upland regions.

[8 marks] 'Western depressions are more important than monsoons in Pakistan.' How far do you agree? Give reasons and examples.

Western depressions are extremely important for winter rainfall and snowfall in northern Pakistan, including the Potohar Plateau and mountain catchments. Their rain helps rain-fed wheat, and stored snow contributes to summer river discharge. However, their influence is seasonal and their rainfall is concentrated towards northern and western areas. Summer monsoons provide much of the rain in north-eastern Pakistan and support Kharif cultivation, while also creating major flood risks. Thus western depressions may be more important for winter water supplies in parts of northern Pakistan, but they are not generally more important than the monsoon for the country as a whole.

[1 mark] (a) Identify one area receiving rainfall from western depressions.

Northern Punjab or the Potohar Plateau is a typical area; verify that it is shown on the missing map.

[3 marks] (b) Describe the distribution shown in the map.

The expected pattern is higher winter precipitation in northern and north-western Pakistan, including the Potohar Plateau and mountain ranges, with smaller totals towards southern Pakistan. The actual map is needed to describe its plotted values and boundaries.

[4 marks] (c) Explain why rainfall occurs in these areas.

Moisture-bearing western disturbances reach northern and western Pakistan along the westerlies. Uplift over the northern ranges cools the air to its dew point, producing rain on lower slopes and snow at high altitude.

[8 marks] (d) Evaluate the importance of western depressions in Pakistan.

Western depressions support winter wheat, replenish soil moisture and create northern mountain snow stores that supply later river flow. Their irregularity can cause drought in rain-fed areas, while intense winter storms may cause landslides, blocked roads and heavy snowfall. They are therefore especially important for northern livelihoods and winter water supply, but their value must be considered alongside summer monsoon rainfall.

Convictional and Relief Rainfall**[1 mark] Define rain shadow.**

An area on the leeward side of a mountain receiving reduced rainfall because uplift has removed moisture from air on the windward side.

[2 marks] State two characteristics of convectional rainfall.

It results from strong surface heating and rising warm, moist air; rainfall is often intense and occurs as localised afternoon showers or thunderstorms.

[2 marks] State two characteristics of relief rainfall.

Moist air is forced uphill over mountains, cools as it rises, condenses into cloud and often causes heavier rain on windward slopes than on the leeward side.

[3 marks] Describe how convectional rainfall forms.

The sun heats the ground and the moist air above it. Warm air rises, expands and cools until water vapour condenses into clouds. Continued uplift forms large clouds and can produce heavy showers or thunderstorms.

[3 marks] Describe how relief rainfall forms.

Moist winds meet a mountain barrier and are forced upwards. The rising air expands, cools and condenses into cloud and precipitation. Descending leeward air warms, causing drier rain-shadow conditions.

[4 marks] Explain how mountains influence rainfall distribution.

On windward slopes, moist air rises, cools and condenses, so rainfall increases. On leeward slopes, air descends and warms after losing moisture, suppressing rainfall and creating a rain shadow. These effects help explain contrasts between wetter northern foothills and some dry inland valleys.

[5 marks] Assess the importance of relief rainfall in Pakistan.

Relief rainfall is important on northern mountain slopes because moist summer winds rise and deposit rainfall, replenishing streams, forests and soil water. However, heavy rainfall can trigger landslides and flash floods. The effect depends on moisture-bearing winds and mountain orientation; arid leeward areas receive less rain. It is important regionally but does not explain all of Pakistan's rainfall.

[8 marks] 'Relief rainfall is the main cause of heavy rainfall in Pakistan.' How far do you agree? Give reasons and examples.

Relief rainfall can produce large totals where moist monsoon air rises over mountain slopes, for example around Murree, supporting forests, agriculture and stream flow. Yet uplift alone is insufficient: an air mass must first contain moisture. The summer monsoon brings that moisture, while western depressions generate important winter rain and snow in northern mountains. Convectional heating can also create localised storms. Conversely, Nok Kundi remains dry because it is far from major moisture sources and partly sheltered by relief. Relief rainfall is therefore highly significant in suitable uplands but cannot be described as Pakistan's principal rainfall cause everywhere.

D- Tropical Cyclones**[1 mark] What is a tropical cyclone?**

An intense, rotating low-pressure storm that forms over warm tropical seas, with strong winds and heavy rain.

[1 mark] Name one area affected by cyclones.

The Sindh coast around Karachi or Thatta.

[2 marks] State two characteristics of tropical cyclones.

Tropical cyclones have very strong rotating winds and bring intense rainfall, sometimes accompanied by storm surges.

[2 marks] Give two effects of cyclones.

Coastal flooding from storm surge and damage to houses or infrastructure from strong winds.

[3 marks] Describe how tropical cyclones develop.

Warm ocean water supplies heat and moisture, causing warm humid air to rise. Falling surface pressure draws in surrounding air, which begins to rotate due to the Coriolis effect. Condensation releases latent heat, strengthening the storm if winds aloft are favourable.

[3 marks] Describe their distribution in Pakistan.

Tropical cyclones approach Pakistan from the Arabian Sea, so coastal Sindh and Balochistan are most directly exposed. Karachi, Thatta and parts of the Makran coast can experience high winds, rain and storm surges; inland districts are less directly exposed.

[4 marks] Explain why cyclones form over warm seas.

Warm sea water causes rapid evaporation, providing moist air that rises and condenses. Condensation releases latent heat, sustaining uplift and lowering surface pressure, allowing rotating winds to intensify.

[4 marks] Explain how cyclones cause flooding.

Strong onshore cyclone winds push seawater onto low coastal land, producing storm surge. Intense rainfall simultaneously overwhelms drains and rivers, so combined coastal and surface flooding can inundate settlements.

[5 marks] Assess the impact of cyclones on Pakistan.

Cyclones threaten lives, fishing boats, coastal housing, ports, transport and electricity infrastructure, while saline storm surge damages farmland. Forecasting and evacuation can reduce fatalities, and some rainfall may relieve dry conditions. Their impacts are serious on exposed coasts but geographically less widespread than riverine monsoon floods.

[8 marks] 'Tropical cyclones are the most dangerous climatic hazard in Pakistan.' How far do you agree? Give reasons and examples.

Tropical cyclones threaten Pakistan's coast through storm surges, intense rainfall and damaging winds. Fishing communities near Thatta and settlements around Karachi can lose boats, homes and access to clean water. Nevertheless, cyclones generally affect a narrower coastal region than major monsoon floods. The 2022 floods damaged extensive areas of Sindh and Balochistan, while prolonged drought repeatedly threatens water supplies in Thar and western Balochistan. Relative danger depends on exposure, preparedness and the event's intensity. Cyclones are potentially catastrophic for coastal communities, but are not consistently Pakistan's most dangerous climatic hazard overall.

E- FLOODS IN PAKISTAN

[1 mark] What is a flood?

The overflow of water onto normally dry land.

[1 mark] Name one area affected by floods.

The Indus Plain in Sindh.

[2 marks] State two natural causes of floods.

Exceptionally heavy monsoon rain and rapid snow or glacier melt.

[2 marks] State two human causes of floods.

Deforestation that increases surface runoff and construction on floodplains that obstructs drainage.

[3 marks] Describe the distribution of floods in Pakistan.

Flooding is concentrated along the Indus and its tributaries in Punjab and Sindh, while flash floods can occur in steep northern valleys and parts of Balochistan. Low-lying Sindh can remain inundated after very heavy rain.

[3 marks] Describe when floods occur.

Riverine and widespread rain floods commonly occur during the summer monsoon, roughly July–September. Spring or summer snowmelt and intense local storms may add to river flow, while coastal floods can occur during cyclones.

[4 marks] Explain how monsoon rainfall causes floods.

Prolonged or intense monsoon rain raises river discharge beyond channel capacity, causing overflow onto floodplains. Where saturated soil cannot absorb more water, rapid surface runoff makes flood peaks higher and flooding more extensive.

[4 marks] Explain how human activity increases flood risk.

Tree clearance reduces interception and root uptake, increasing runoff into rivers. Building over floodplains and blocking natural drains exposes more people and prevents floodwater from spreading or escaping safely.

[5 marks] Assess the effectiveness of flood management methods.

Embankments can protect densely settled areas from smaller floods but may fail or divert water elsewhere. Early-warning systems, evacuation plans and restored floodplains can reduce casualties and losses. In the 2022 Sindh floods, prolonged inundation showed that structural defences alone are inadequate; combinations of preparedness, appropriate land-use planning and natural water storage are more resilient.

[8 marks] 'Human factors are more important than natural factors in causing floods.' How far do you agree? Give reasons and examples.

Natural causes, especially exceptional monsoon rainfall and high river flows, can trigger floods on an enormous scale, as the 2022 Sindh floods demonstrated. Human activities often magnify the disaster: deforestation speeds up runoff, settlements occupy natural floodplains and blocked urban drains increase local inundation. Poor drainage can prolong floodwater retention, while embankments may transfer risk downstream. It is therefore misleading to treat natural and human causes as independent or universally rank one above the other. Extreme rainfall usually initiates the major event; human land use and flood preparedness strongly determine how severely particular communities are affected.

F- DROUGHTS IN PAKISTAN

[1 mark] What is a drought?

A prolonged period of unusually low rainfall that creates a shortage of available water.

[1 mark] Name one type of drought.

Meteorological drought.

[2 marks] State two causes of drought.

Prolonged below-average rainfall and unusually high temperatures that increase evaporation.

[2 marks] State two areas affected by drought.

Tharparkar in Sindh and Chagai district in Balochistan.

[3 marks] Describe the distribution of droughts in Pakistan.

Drought is particularly common in the arid south-east, including Tharparkar, and the dry western parts of Balochistan. Rain-fed communities are especially vulnerable where groundwater or canal supplies are limited.

[3 marks] Describe different types of drought.

Meteorological drought is a sustained rainfall deficit; agricultural drought occurs when soil moisture becomes insufficient for crops; hydrological drought develops when river, reservoir or groundwater supplies fall below normal.

[4 marks] Explain how low rainfall causes drought.

When seasonal rainfall fails, soil moisture is not replenished and rain-fed crops cannot obtain enough water. Continued rainfall deficits also reduce groundwater recharge and reservoir inflow, worsening water shortages.

[4 marks] Explain how human activity contributes to drought.

Over-extraction of groundwater can lower the water table, leaving little reserve during dry periods. Deforestation and degraded soils reduce infiltration and moisture retention, making agricultural drought more severe.

[5 marks] Assess the impacts of drought on people.

Drought reduces crop yields, kills livestock and creates drinking-water shortages, especially for rain-fed communities in Tharparkar. Families may lose income, face food insecurity and migrate. Irrigation and water storage can lessen the impact but are costly or unavailable in remote areas; prolonged drought can therefore have serious cumulative social effects.

[8 marks] 'Drought is the most serious climatic hazard in Pakistan.' How far do you agree? Give reasons and examples.

Drought develops slowly but can devastate livelihoods over repeated seasons. In Tharparkar and arid Balochistan it reduces pasture, crops, livestock incomes and drinking water, causing food insecurity and migration. However, floods often cause more sudden loss of life and destroy roads, homes and crops over a wide area, as in 2022. Tropical cyclones are also severe for the coast. Drought's seriousness depends on duration, water reserves and reliance on rain-fed farming. It is among Pakistan's major climatic hazards, especially for arid rural populations, but cannot be labelled the single most serious hazard in every region and year.

H- SEASONS OF PAKISTAN

[1 mark] Name one season in Pakistan.

Summer.

[2 marks] State two characteristics of the monsoon season.

Generally hot and humid in many lowland areas, with seasonal heavy rainfall brought by the monsoon.

[3 marks] Describe seasonal changes in temperature.

Summer brings high temperatures across lowland Punjab and Sindh; winter is cooler nationwide, with severe cold and snowfall in northern uplands. Spring and autumn are transitional seasons with more moderate conditions.

[4 marks] Explain differences between summer and winter rainfall.

Summer rainfall mainly comes from moisture-bearing monsoon winds arriving from the south-west and east, often causing heavy downpours. Winter precipitation is chiefly associated with western depressions, bringing rain to northern areas and snow to mountains.

[5 marks] Assess how seasons affect human activities.

Seasons determine cropping calendars: Kharif rice benefits from summer warmth and monsoon water, while Rabi wheat uses cooler winter conditions and irrigation or winter rain. Seasonal snow affects northern roads and tourism; extreme summer heat increases water demand. Seasonal planning is important, although abrupt floods and droughts can outweigh ordinary seasonal patterns.

[8 marks] 'Seasonal changes have a greater impact than climatic hazards.' How far do you agree?

Normal seasonal changes structure agriculture, electricity demand, tourism and water use throughout Pakistan. Farmers plan wheat for the cooler Rabi season and rice for the warm Kharif season, while northern roads may be affected by predictable winter snow. However, unusual climatic hazards cause losses far beyond ordinary seasonal adjustments: the 2022 floods destroyed infrastructure and crops, and prolonged drought can force livestock sales and migration in Tharparkar. The comparison therefore depends on whether effects are measured by continuous nationwide influence or exceptional damage. Seasonal changes shape daily economic activity; hazards are often more damaging when they exceed the capacity of communities to adapt.

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UNIT

1.2.3

CLIMATE IMPACTS ON PEOPLE AND THE ECONOMY

A-IMPACTS ON LIFE IN DEFERENT REGIONS**[1 mark] Name one climatic problem faced in lowland areas.**

Extreme summer heat or monsoon flooding.

[1 mark] State one feature of life in arid regions.

Settlements may depend on scarce groundwater and people may practise drought-resistant pastoralism.

[2 marks] State two effects of climate on daily life in highland areas.

Cold winters increase heating needs, and snow can block roads or isolate villages.

[2 marks] Give two ways people adapt to hot climates.

Use shaded or well-ventilated housing and avoid strenuous outdoor work during the hottest hours.

[3 marks] Describe how climate affects life in highland areas.

Highland communities experience colder temperatures and winter snow, which may restrict road access and raise heating costs. Shorter growing seasons favour certain crops and pastoral activities; summer conditions can encourage tourism.

[3 marks] Describe how climate affects life in lowland areas.

In lowland Punjab and Sindh, high summer temperatures increase irrigation and drinking-water demand. Warm growing seasons support crops such as cotton and rice, but monsoon downpours can flood fields and settlements.

[4 marks] Explain how climate affects housing in different regions.

In hot lowlands, thick walls, courtyards, shade and ventilation can reduce indoor heat. In cold uplands, insulated walls and steeper roofs help retain warmth and shed snow, improving safety and comfort.

[4 marks] Explain how climate affects transport in mountainous areas.

Heavy winter snowfall can block passes and mountain roads, interrupting supplies and access to hospitals. Rain-induced landslides can damage road surfaces and bridges, further isolating mountain communities.

[5 marks] Assess the impact of climate on people's daily lives in Pakistan.

Climate shapes housing, clothing, seasonal work, crops and transport across Pakistan. Mountain cold and snow can isolate settlements; extreme lowland heat increases water and cooling costs; aridity limits farming in Balochistan and Thar. However, infrastructure, income and forecasting modify exposure. Climatic effects are greatest where households cannot afford protective housing, irrigation or reliable transport.

[8 marks] 'Climate has a greater impact on people in rural areas than urban areas.' How far do you agree? Give reasons and examples.

Rural households often depend directly on rainfall, grazing and crops, making drought in Tharparkar or flooding in Sindh particularly damaging to income and food security. Remote upland settlements can be cut off by winter snow or landslides. Yet urban populations also face severe climatic problems: heat stress, water shortages and flash flooding in Karachi can affect large numbers of residents,

particularly in informal settlements. Wealth, public services and land-use decisions influence vulnerability as much as the rural–urban distinction. Climate can have a stronger livelihood effect in rain-fed rural areas, but it also produces substantial health and infrastructure losses in cities.

B-IMPACTS ON AGRICULTURE

[1 mark] Name one crop grown in lowland areas.

Wheat.

[1 mark] State one effect of drought on crops.

Crop wilting or reduced yield.

[2 marks] State two effects of floods on agriculture.

Floodwater can destroy standing crops and deposit sediment or debris over farmland.

[2 marks] Give two effects of drought on farming.

Lower yields from soil-moisture shortage and livestock fodder shortages.

[3 marks] Describe the effects of floods on agriculture.

Floodwater can drown standing crops, deposit sand and debris, erode fertile topsoil and damage irrigation channels. In severe flooding, farmers also lose stored seeds and access to fields.

[3 marks] Describe the effects of drought on agriculture.

Drought reduces soil moisture and crop growth, raises irrigation demand and may cause crop failure. Limited fodder and water also reduce livestock productivity and farm incomes.

[4 marks] Explain how floods damage agricultural land.

Fast-flowing water removes fertile topsoil and can cut gullies through fields. Prolonged waterlogging suffocates roots and may leave sediment, debris or damaged irrigation channels that delay the next planting season.

[4 marks] Explain how drought reduces agricultural output.

Insufficient rainfall reduces soil moisture and plant photosynthesis, leading to poor germination and lower yields. Reduced river and reservoir inflow can also limit canal irrigation, so farmers may leave fields uncultivated.

[5 marks] Assess the impact of climate on agricultural production in Pakistan.

Climate controls growing seasons and supplies essential heat and moisture. Monsoon rainfall supports Kharif crops, but heavy floods can destroy cotton and rice fields in Sindh; drought cuts yields in rain-fed regions, while heatwaves stress wheat at sensitive growth stages. Irrigation, drainage and resilient crop varieties reduce vulnerability, yet require investment.

[8 marks] 'Floods have a greater impact on agriculture than droughts.' How far do you agree? Give reasons and examples.

Floods can destroy standing crops, wash away soil, damage canals and leave farmland waterlogged, as the 2022 inundation in Sindh demonstrated. The shock may be severe across a large area within days. Drought acts more gradually but can destroy successive harvests, exhaust groundwater and force livestock sales, especially in Tharparkar and Balochistan. Where irrigation and storage are available, drought losses may be reduced, while flood protection can limit inundation. Floods can be more destructive in individual extreme years, but recurring drought may impose equally serious or larger cumulative losses in arid farming regions.

C-IMPACTS ON INDUSTRY

[1 mark] Name one industry affected by climate.

The cotton textile industry.**[1 mark] State one effect of floods on industry.**

Floodwater can inundate factories and halt production.

[2 marks] State two impacts of floods on industry.

Factories can be flooded and equipment damaged; road closures also interrupt deliveries of raw materials and finished goods.

[2 marks] Give two impacts of drought on industry.

Reduced water availability for processing and lower hydropower generation where reservoir inflows fall.

[3 marks] Describe how floods affect industry.

Floods can damage factory buildings and machinery, interrupt power supplies and close roads or ports. Flooded fields can also reduce cotton supply to textile factories.

[3 marks] Describe how drought affects industrial production.

Drought reduces water available to water-intensive industries and may lower hydropower output where reservoir levels fall. Poor agricultural yields also reduce supplies of cotton and other raw materials.

[4 marks] Explain why floods disrupt industrial production.

Floodwater directly damages machinery and electrical systems, making factories unsafe or inoperable. Flooded roads, damaged bridges and power outages then prevent workers and raw materials from reaching production sites.

[4 marks] Explain how drought leads to energy shortages.

Drought reduces river discharge and reservoir levels, leaving less water available to drive hydroelectric turbines. Electricity shortages or higher reliance on imported thermal fuels then increase manufacturing costs.

[5 marks] Assess the impact of climate on industrial development.

Climate hazards can damage industrial sites, disrupt transport and reduce electricity and raw-material supplies. Textile mills are indirectly exposed when floods or drought harm cotton production. However, the impact varies by location and infrastructure; reliable backup power, drainage and diversified sourcing can reduce losses.

[8 marks] 'Climate is the main factor affecting industrial development in Pakistan.' How far do you agree? Give reasons and examples.

Climate is an important industrial constraint: floods can halt factories and damage roads, while drought cuts water and potentially hydroelectric generation. Poor cotton harvests also restrict textile inputs. However, factories depend heavily on finance, reliable energy, skilled labour, market access and policy stability, even in years without extreme weather. Industrial clusters around Karachi and Faisalabad reflect transport, labour and investment as well as climate. Climate can cause severe interruptions and should be addressed in industrial planning, but is rarely the sole or principal factor determining industrial development across Pakistan.

D-IMPACTS ON INFRASTRUCTURE**[1 mark] Name one type of infrastructure affected by climate.**

Roads.

[2 marks] State two effects of floods on infrastructure.

Floods can wash away bridges and undermine road foundations.

[3 marks] Describe how floods affect infrastructure.

Floodwater erodes roads, damages bridges and submerges railway tracks, interrupting access to hospitals, markets and schools. Repair costs increase and remote settlements can become isolated.

[4 marks] Explain how floods damage transport systems.

Fast water scours bridge supports and washes away embankments, breaking road and rail links. Prolonged inundation softens road foundations and prevents maintenance teams from accessing damaged sections.

[4 marks] Explain how drought affects water supply systems.

Less rainfall and reduced river flows can lower reservoir and groundwater supplies. Water-supply authorities may ration deliveries or pump from deeper aquifers at greater energy cost.

[5 marks] Assess the impact of climate hazards on infrastructure.

Floods and landslides can quickly destroy roads, bridges, power lines and drainage networks, while prolonged drought places pressure on pipelines, reservoirs and pumping systems. Infrastructure with good design, drainage and early-warning arrangements generally withstands hazards better, but repair costs remain substantial.

[8 marks] 'Flooding causes more damage to infrastructure than drought.' How far do you agree? Give reasons and examples.

Flooding often causes abrupt and visible infrastructure damage: bridges, roads, railways and power lines were affected by the 2022 floods. Drought usually operates more slowly by lowering reservoir levels and reducing reliable water supplies, which can impose high long-term costs on households, agriculture and industry. Flood damage is often geographically concentrated and expensive to repair, while drought affects larger water systems over time. Flooding may cause greater immediate physical destruction, but the overall cost depends on the length and severity of each hazard and the infrastructure exposed.

E-IMPACTS OF FLOODS**[1 mark] What is one effect of floods on people?**

Displacement from home.

[2 marks] State two impacts of floods on settlements.

Homes may be destroyed and whole settlements may become inaccessible.

[3 marks] Describe the impacts of floods on people.

Floods can kill or injure people, destroy homes and displace families. Contaminated drinking water and damaged sanitation increase health risks, while lost crops and jobs reduce household income.

[4 marks] Explain how floods affect health.

Floodwater can contaminate drinking supplies with sewage, increasing diarrhoeal disease risk. Standing water may also create breeding sites for mosquitoes, increasing vector-borne disease risks after flooding.

[5 marks] Assess the impacts of flooding in Pakistan.

Flooding creates immediate deaths, injuries and displacement and can destroy farmland, transport and public services. In the 2022 floods many communities in Sindh faced prolonged inundation, interrupted schooling and damaged water supplies. Emergency aid is vital, but restoring livelihoods and health services often takes much longer than floodwaters take to recede.

F-IMPACTS OF DROUGHTS

[1 mark] What is one impact of drought on people?

Drinking-water shortage.

[2 marks] State two effects of drought on agriculture.

Poor crop yields and livestock losses.

[3 marks] Describe the impacts of drought on people.

Drought can cause drinking-water shortages, lost farm income and livestock deaths. Household food insecurity may lead to migration, debt and interrupted schooling, especially in rain-fed drylands.

[4 marks] Explain how drought affects food supply.

Lack of rainfall reduces soil moisture and grain production, while low reservoir or groundwater levels limit irrigation. Reduced pasture then weakens livestock and further reduces household milk and meat supply.

[5 marks] Assess the impacts of drought in Pakistan.

Drought reduces drinking water, crops and pasture, increasing food prices and migration pressure in places such as Tharparkar and western Balochistan. Better water harvesting, drought-resilient crops and early warning help, but poor households may not have the finance or infrastructure to benefit fully.

[8 marks] 'Drought has a greater impact on people than floods.' How far do you agree? Give reasons and examples.

Drought can have prolonged effects on poor, rain-fed households: repeated harvest failure, livestock loss and falling water tables in Tharparkar may cause food insecurity and migration. Floods can be more sudden, destroying houses, roads and standing crops over a large area, as in Sindh in 2022. The impact depends on season, exposure and social vulnerability. Drought may be more damaging cumulatively in arid districts without secure water supplies; major floods can impose greater immediate losses and displacement in densely populated river plains.

H-REGIONAL COMPARISON

[1 mark] Name one region with a harsh climate.

The high mountain valleys of northern Pakistan.

[2 marks] State two differences between coastal and inland climates.

Coastal areas such as Karachi have smaller annual temperature ranges because the sea heats and cools slowly, whereas inland places such as Sukkur tend to experience hotter summers and a wider temperature range.

[3 marks] Describe differences between highland and lowland regions.

Highland areas have colder temperatures, shorter growing seasons and often winter snow. Lowland areas are generally warmer with longer growing seasons and a larger share of irrigated field crops, but can experience severe summer heat.

[4 marks] Explain why economic activities vary between regions.

Climate restricts crop choice and length of growing season: rice and cotton grow in warm irrigated plains, while colder highlands favour different crops and seasonal tourism. Temperature, moisture and snow conditions also affect transport and investment costs.

[5 marks] Assess how climate influences regional development.

Climate affects agricultural potential, household energy needs and transport reliability. Coastal moderation supports port operations, whereas flood-prone lowlands may face huge infrastructure

losses. However, roads, skills, energy, investment and markets can partly offset climatic limitations, so climate does not determine regional income on its own.

[8 marks] 'Climate is the main factor affecting economic development in Pakistan.' How far do you agree? Give reasons and examples.

Climate strongly affects regional development: irrigation is essential for arid farming regions, mountain snowfall can isolate settlements, and extreme heat raises water and energy demand in lowlands. Flooding can repeatedly damage infrastructure in Sindh. However, economic activity also reflects access to ports, transport, trained workers, markets and investment. Karachi's port and industry demonstrate that favourable market access can offset climatic discomfort, while remote areas may remain poorly connected even when the climate is pleasant. Climate is an important constraint and opportunity, but human and economic factors interact with it rather than being secondary everywhere.

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A-CLIMATE CHANGE & GREENHOUSE GASES**[1 mark] Define climate change.**

A long-term change in average climate conditions or their variability over decades or longer.

[1 mark] Name one greenhouse gas.

Carbon dioxide (CO₂).

[1 mark] State one source of CO₂.

Burning coal, oil or natural gas.

[2 marks] State two greenhouse gases.

Carbon dioxide and methane.

[2 marks] Give two human causes of climate change.

Burning fossil fuels and deforestation.

[3 marks] Describe the greenhouse effect.

Sunlight reaches Earth's surface and is absorbed, warming it. The surface emits long-wave infrared radiation. Greenhouse gases absorb and re-emit some outgoing radiation, keeping the lower atmosphere warmer than it would otherwise be.

[3 marks] Describe how greenhouse gases cause warming.

CO₂, methane and other greenhouse gases absorb part of the infrared radiation emitted by Earth's surface. Increasing their concentration retains more energy in the lower atmosphere and raises average global temperatures.

[4 marks] Explain how the enhanced greenhouse effect causes global warming.

Burning fossil fuels and removing forests increase atmospheric concentrations of CO₂ and other greenhouse gases. These gases absorb more outgoing infrared radiation and re-emit it, creating an energy imbalance that raises global average temperatures.

[5 marks] Assess the importance of greenhouse gases in climate change.

Greenhouse gases are central to recent human-caused warming because CO₂ from fossil fuels and methane from agriculture and energy systems increase heat retention. The natural greenhouse effect is necessary for life, but the human-enhanced effect drives rising temperatures. Natural influences such as volcanic eruptions and solar variability can affect climate, yet they do not explain the observed sustained recent warming to the same extent.

[8 marks] 'Greenhouse gases are the main cause of climate change.' How far do you agree? Give reasons and examples.

Human activities have increased greenhouse gases, especially CO₂ from burning fossil fuels and land-use change, and methane from livestock and fossil-fuel systems. These gases absorb outgoing infrared radiation, strengthening the greenhouse effect and driving recent global warming. Natural factors such as volcanic eruptions and changes in solar output also influence climate, but their effects are often short-lived or insufficient to explain the sustained modern warming trend. Rising temperatures alter glacier mass, rainfall patterns and sea-level conditions relevant to Pakistan. Greenhouse gases are therefore the main driver of recent long-term global warming, while natural

variability and regional geography still influence Pakistan's local climate impacts.

B-NATURAL CAUSES

[1 mark] Name one natural cause of climate change.

Variation in solar activity.

[1 mark] What are sunspots?

Temporary dark patches on the Sun's surface associated with strong magnetic activity; their number varies with the solar cycle.

[2 marks] State two natural causes of climate change.

Changes in Earth's orbit and major volcanic eruptions.

[2 marks] Give two effects of volcanic eruptions.

Volcanic ash and sulfate aerosols can reflect sunlight, temporarily cooling the surface; volcanic gases may also affect atmospheric chemistry.

[3 marks] Describe how orbital changes affect climate.

Long-term variations in the shape of Earth's orbit, the tilt of its axis and the direction of its axis change the seasonal and regional distribution of solar energy. Over thousands of years these cycles contribute to ice-age and interglacial changes.

[3 marks] Describe how sunspots affect temperature.

Sunspot numbers reflect changes in solar magnetic activity. They are associated with small changes in total solar radiation that can slightly affect climate, but do not account for recent sustained global warming.

[4 marks] Explain how volcanic eruptions affect climate.

Large eruptions inject sulfur dioxide high into the atmosphere, where sulfate aerosols reflect some incoming sunlight and can cool the surface for a few years. Eruptions also release gases, but their modern annual CO₂ contribution is far below that from human activity.

[8 marks] 'Natural causes are more important than human causes.' How far do you agree? Give reasons and examples.

Natural changes in solar radiation, volcanic aerosols and long-term orbital cycles influence climate. For example, a large volcanic eruption can temporarily cool the Earth by reflecting sunlight. Yet orbital cycles act over thousands of years and solar variability has not provided the sustained forcing needed to explain recent warming. Human emissions of CO₂ and methane from fuel combustion and land use have increased greenhouse-gas concentrations rapidly. Natural variability affects particular years and regions, but evidence attributes the principal cause of recent global warming to human activities rather than natural forces.

C-HUMAN CAUSES

[1 mark] Name one fossil fuel.

Coal.

[2 marks] State two effects of fossil fuel use.

Fossil fuel combustion releases CO₂ and produces air pollutants such as particulates and sulfur dioxide.

[3 marks] Describe how fossil fuels cause climate change.

Coal, oil and gas contain carbon formed over geological timescales. When burned for electricity, transport or industry, their carbon is oxidised to CO₂ and accumulates in the atmosphere,

strengthening the greenhouse effect.

[4 marks] Explain how fossil fuels increase global warming.

Fossil fuel combustion transfers long-stored carbon into atmospheric CO₂. Higher CO₂ concentration absorbs more of Earth's outgoing infrared radiation, creating a persistent warming influence over time.

[5 marks] Assess the importance of human activities.

Fossil fuel combustion is a major source of human CO₂, while deforestation reduces carbon uptake and agriculture emits methane and nitrous oxide. These activities explain sustained recent warming far better than changes in solar radiation or volcanic activity. Their effects are global, although Pakistan's contribution is small relative to that of major historical emitters.

[8 marks] 'Human activities are the main cause of climate change.' How far do you agree? Give reasons and examples.

Burning coal, oil and gas for energy, transport and industry emits large quantities of CO₂, strengthening the greenhouse effect. Deforestation removes carbon sinks, while livestock and rice cultivation emit methane. Such human influences explain the sustained rise in global greenhouse-gas concentrations and recent warming. Natural influences such as volcanoes and solar variability still affect climate but cannot explain the long-term modern trend on their own. Pakistan faces severe impacts through glacier change, heat stress and extreme rain, despite its relatively small historical emissions. Human activities are the principal cause of recent climate change, although natural processes shape short-term variability and regional patterns.

D-URBANISATION

[1 mark] What is an urban heat island?

An urban area with higher temperatures than the surrounding countryside, especially at night.

[1 mark] Name one city affected.

Karachi.

[2 marks] State two causes of urban heat islands.

Dark asphalt and concrete absorb and retain solar heat, while limited vegetation reduces cooling by shade and evapotranspiration.

[2 marks] Give two effects of urbanisation.

Increasing surface runoff from paved land and rising energy demand for transport or air-conditioning.

[3 marks] Describe the urban heat island effect.

Buildings and paved surfaces absorb solar radiation by day and release heat at night, while sparse trees reduce evaporative cooling. Traffic and air-conditioning add waste heat, making densely built areas warmer than nearby rural land.

[3 marks] Describe how cities increase temperature.

Urban expansion replaces vegetation and permeable soil with asphalt, concrete and roofs that store heat. Vehicles and cooling systems release additional heat, while taller buildings may reduce ventilation in dense streets.

[4 marks] Explain why cities are warmer than rural areas.

Concrete and asphalt absorb and retain more solar energy than vegetated ground, releasing heat slowly overnight. Less vegetation means reduced shade and evapotranspiration, while traffic and buildings release waste heat, raising urban temperatures.

[5 marks] Assess the impact of urbanisation on climate change.

Urbanisation increases local temperatures through the urban heat island effect and can raise energy consumption and associated CO₂ emissions. However, urban growth does not automatically increase emissions per person: efficient public transport and dense housing can reduce energy use compared with sprawling development. The global climate impact depends on energy sources, planning and total consumption, not simply city size.

[8 marks] 'Urbanisation is a major contributor to climate change.' How far do you agree?

Urbanisation can contribute to climate change when expanding cities increase electricity use, vehicle emissions and construction-related CO₂. Karachi illustrates the local urban heat island caused by paved surfaces, reduced vegetation and waste heat, which can further increase cooling demand. Nevertheless, urban heat islands are primarily local temperature effects, not themselves a direct explanation of global warming. Fossil fuel combustion across power generation, transport and industry is a more direct global driver. Well-planned compact cities, public transport, trees and renewable electricity can reduce urban emissions. Urbanisation is a substantial influence where development is carbon-intensive, but its effect depends on infrastructure and energy choices.

E-DEFORESTATIONS AND AGRICULTURE

[1 mark] What is deforestation?

The permanent or long-term removal of forest cover, often to change land use.

[1 mark] Name one source of methane.

Cattle and other ruminant livestock.

[2 marks] State two effects of deforestation.

It reduces carbon uptake by trees and increases soil erosion when protective vegetation is lost.

[2 marks] Give two sources of methane.

Enteric fermentation by cattle and methane released from flooded rice fields.

[3 marks] Describe how deforestation affects climate.

Clearing forests reduces the number of trees absorbing CO₂ through photosynthesis. Burning or decay of cleared biomass can release stored carbon, while exposed soil may lose carbon and moisture.

[4 marks] Explain how livestock farming contributes to climate change.

Cattle and other ruminants produce methane as microbes digest feed in their stomachs. Methane enters the atmosphere and traps outgoing infrared radiation, contributing to the enhanced greenhouse effect.

[5 marks] Assess the impact of deforestation.

Deforestation releases stored carbon and reduces carbon sinks, while exposing soils to erosion and increasing runoff. It also harms habitat and can worsen regional water stress. However, globally fossil-fuel CO₂ is a larger direct cause of recent warming, and the impacts of tree loss depend on forest type and land management.

[8 marks] 'Deforestation is the most important cause of climate change.' How far do you agree?

Forest clearance adds CO₂ when wood is burnt or decomposes and removes trees that would otherwise absorb atmospheric carbon. It also increases erosion and can alter local rainfall and drainage. Yet fossil-fuel combustion in power, transport and industry is a major continuing source of global CO₂, while farming adds methane and nitrous oxide. Deforestation is important in climate mitigation and local environmental protection, including in Pakistan's mountain watersheds, but its global contribution should not be treated as greater than all other human emissions. Reducing

forest loss must be combined with cleaner energy and agricultural improvements.

F-PAKISTAN

[1 mark] State one reason Pakistan is vulnerable to climate change.

Pakistan has extensive populations and farms on flood-prone Indus floodplains.

[2 marks] State two reasons Pakistan is vulnerable.

Extensive floodplain settlement and dependence on climate-sensitive agriculture.

[3 marks] Describe why Pakistan is vulnerable to climate change.

Pakistan combines high exposure to monsoon floods, northern glacier and snow changes, coastal sea-level rise and extreme heat. Many households rely on agriculture or have limited resources to adapt.

[4 marks] Explain why climate change is a major issue for Pakistan.

Changes in the timing of monsoon rainfall threaten crops and settlements, while glacier retreat and irregular snowmelt create water-management uncertainty. Coastal districts also face seawater intrusion, and poorer communities may lack resilient housing or alternative livelihoods.

[5 marks] Assess the impacts of climate change on Pakistan.

Climate change affects Pakistan through heavier rainfall extremes, heatwaves, glacier loss, coastal intrusion and agricultural uncertainty. The 2022 floods illustrate the enormous damage an extreme rainfall event can cause. Vulnerability is increased by exposure of farms and settlements, limited drainage and unequal access to adaptation resources. Protecting water security and public services is essential.

[8 marks] 'Pakistan is highly vulnerable to climate change.' How far do you agree?

Pakistan is vulnerable because much of its population, agriculture and infrastructure lies on floodplains or in heat- and drought-exposed areas. Exceptional monsoon rain caused catastrophic flooding in 2022, while northern glacier changes alter long-term river-flow risks and the Indus Delta faces seawater intrusion. Poorer households often have little savings, insurance or resilient infrastructure to recover. However, vulnerability varies: early-warning systems, improved drainage, stronger buildings and resilient farming can reduce losses. Pakistan is highly vulnerable in several climatic and social respects, but the severity of future impacts depends partly on how effectively adaptation is funded and implemented.

A-GLACIAL MELTING

[1 mark] What is a glacier?

A persistent body of ice formed from compacted snow that moves slowly under gravity.

[2 marks] State two impacts of glacier melting.

Initially increased river flow and greater risk of glacial-lake outburst floods.

[3 marks] Describe the impacts of glacier melting in Pakistan.

Glacier retreat can enlarge unstable glacial lakes and raise the risk of sudden outburst floods in northern valleys. Initially meltwater may increase some river flows, but sustained ice loss can reduce the long-term reserve supporting rivers.

[4 marks] Explain how glacier melting affects river flow.

Rising temperatures increase ice melt, which can temporarily raise river discharge and enlarge glacial lakes. As glacier volume falls over longer periods, less stored ice remains for future meltwater, potentially making dry-season water supplies less reliable.

[5 marks] Assess the impacts of glacier melting in Pakistan.

Northern glaciers store freshwater that can support river flow and agriculture. Faster melting can increase short-term runoff and glacial-lake outburst flood risk, harming mountain roads and villages. Over time, shrinking ice reserves threaten the reliability of river flows, although seasonal snow and rainfall also contribute. Monitoring lakes, managing reservoirs and improving warning systems can reduce risks but cannot reverse global warming locally.

[8 marks] 'Glacier melting is the most serious environmental impact of climate change.' How far do you agree? Give reasons and examples.

Glacier retreat threatens mountain ecosystems and communities through glacial-lake outburst floods and eventual reductions in stored ice reserves. In Gilgit-Baltistan, sudden floods can damage settlements, bridges and roads, while the Indus system relies partly on northern snow and ice melt. However, extreme monsoon floods, drought, heatwaves and sea-level rise create serious hazards for much larger or different populations. The importance of glacier loss is especially high for northern watersheds and long-term water security, but it cannot be called the single most serious environmental impact for every part of Pakistan. Both glacier monitoring and nationwide emissions reduction and adaptation are needed.

B-SEA LEVEL RISE

[1 mark] What is meant by sea level rise?

A long-term rise in average sea level relative to the land.

[1 mark] Name one coastal area affected by it.

The Indus Delta near Thatta.

[2 marks] State two impacts of sea level rise.

Coastal erosion and saltwater intrusion into agricultural soils and freshwater sources.

[3 marks] Describe the impacts of sea level rise.

Rising seas increase coastal flooding and erosion and push saline water into low-lying delta channels and aquifers. This can damage farmland, mangroves and settlements in the Indus Delta.

[4 marks] Explain how sea level rise affects coastal areas.

As sea level rises, high tides and storm surges can reach farther inland, inundating low coastal land. Saltwater can penetrate the Indus Delta's soils and aquifers, lowering crop yields and access to safe drinking water.

[8 marks] 'Sea level rise is the greatest threat to Pakistan's environment.' How far do you agree?

The Indus Delta faces erosion, saltwater intrusion and increased coastal flood risk as sea level rises, threatening farming, fishing and mangrove habitats. Local freshwater flows, embankments and mangrove restoration also affect vulnerability. Yet inland flooding, heat stress and glacier change threaten other large regions. Sea-level rise is a major long-term threat for coastal Sindh, but is not the greatest environmental threat to every part of Pakistan.

C-EXTREME WEATHER

[1 mark] Name one extreme weather event.

A severe monsoon flood.

[1 mark] What is a heatwave?

A heatwave is a period of abnormally high temperatures lasting several consecutive days.

[2 marks] Give two impacts of floods.

Floods can destroy homes and crops, and contaminate drinking-water supplies.

[2 marks] State two impacts of heatwaves.

Heatwaves can cause heatstroke and increase demand for drinking water or electricity.

[3 marks] Describe the impacts of extreme weather events.

Extreme rainfall can flood settlements, destroy crops and bridges and spread contaminated water. Heatwaves may cause illness and crop stress, while strong storms can interrupt power and transport.

[4 marks] Explain how floods damage settlements.

Fast or prolonged floodwater may destroy walls and foundations and make housing uninhabitable. Damage to drains and roads can cut access to markets and hospitals, displacing households.

[4 marks] Explain how heatwaves affect people.

Prolonged extreme heat can overwhelm the body's cooling mechanisms, increasing heat exhaustion and heatstroke, especially among outdoor workers. Extra water and electricity demand can strain already limited services.

[5 marks] Assess the impacts of extreme weather events.

Extreme weather can generate simultaneous human, environmental and economic damage: floods destroy housing and crops, heatwaves threaten health and drought reduces farm income. The 2022 floods showed how widespread losses can overwhelm drainage and relief services. Early warnings and stronger infrastructure reduce vulnerability, but poor households remain particularly exposed.

[8 marks] 'Extreme weather events are increasing due to climate change.' How far do you agree?

A warmer atmosphere can hold more moisture and raise the intensity of some heavy-rainfall events, while higher baseline temperatures increase heatwave frequency or severity. Pakistan has experienced damaging events, including the extreme 2022 floods. However, individual floods depend on circulation, local rainfall patterns, land use and natural variability; attributing every storm solely to climate change would be misleading. Evidence supports increasing heat extremes and heightened risk of some heavy-rainfall events as the climate warms, while the pattern differs between hazards

and regions. Better observation, early warning and climate adaptation are needed alongside emissions reduction.

D-HEALTH

[1 mark] Name one disease linked to climate change.

Dengue fever.

[2 marks] State two health impacts of climate change.

More heat-related illness and potentially wider opportunities for mosquito-borne disease transmission under suitable conditions.

[3 marks] Describe the impacts of climate change on health.

Hotter temperatures raise heat exhaustion and heatstroke risks, particularly for outdoor workers and older people. Floods can contaminate drinking water, while some warmer or wetter conditions may favour mosquito populations and disease transmission.

[4 marks] Explain how climate change increases disease risk.

Heavy rainfall and flooding can leave stagnant water where mosquitoes breed, increasing disease risk where the pathogen and mosquito are present. Flood damage to sanitation can contaminate drinking water and raise gastrointestinal infection risks.

[5 marks] Assess the impact of climate change on health.

Climate change increases heat stress and can amplify waterborne disease risks after flooding; suitable warmer or wetter conditions may also favour mosquitoes in some areas. Exposure is especially severe where housing, clean water and healthcare are inadequate. Surveillance and resilient health services help, but the scale of risk depends on local conditions rather than temperature alone.

[8 marks] 'Climate change has a greater impact on health than on the economy.' How far do you agree?

Climate change can cause direct health losses through heatwaves and indirect risks from floods, unsafe water and changing disease exposure. Karachi's heat stress and flood-related sanitation failures illustrate the danger for vulnerable residents. Yet the economic effects are also extensive: floods destroy crops, roads and workplaces, while drought reduces rural income and can raise food prices. Health and economic outcomes are closely linked because poverty worsens access to treatment and disrupted work reduces household spending on nutrition. In some urban communities health losses may be immediate, while for farming households long-term livelihood damage can be equally severe. Neither category is consistently greater everywhere.

E-INFRASTRUCTURE

[1 mark] Name one type of infrastructure affected by climate change.

Roads.

[2 marks] State two effects on infrastructure.

Flood damage to roads and destruction or failure of bridges.

[3 marks] Describe how climate change affects infrastructure.

Extreme rain and flooding can wash away bridge approaches, undermine road foundations and damage electricity networks. Heat can deform some road surfaces and increase electricity demand, while coastal storms threaten exposed infrastructure.

[4 marks] Explain how floods damage infrastructure.

High-velocity floodwater erodes road embankments and bridge supports, causing structural failure. Prolonged inundation weakens road bases and damages electricity and communication equipment, slowing recovery.

[5 marks] Assess the impact on infrastructure.

Climate extremes expose roads, bridges, water networks and power systems to costly damage. The 2022 floods caused major transport disruption, isolating communities and hindering relief. Resilient design, maintained drains and avoiding vulnerable floodplains can reduce costs, but repeated extreme events make long-term planning essential.

[8 marks] 'Flooding causes the greatest damage to infrastructure.' How far do you agree?

Flooding often causes severe direct infrastructure losses: floodwater can wash away bridges, cut highways and damage power networks, as during the 2022 disaster. However, extreme heat can damage surfaces and raise electricity demand, while drought undermines water storage and supply infrastructure, sometimes over several years. Coastal storm surges create additional local risks. The greatest infrastructure damage depends on exposure and the time period examined. Flooding is particularly destructive to transport and settlement infrastructure during extreme events, but drought and heat also impose important cumulative costs.

F-ECONOMY

[1 mark] State one sector affected by climate change.

Agriculture.

[2 marks] State two impacts on agriculture.

Lower crop yields from heat or water stress, and destruction of fields by severe floods.

[3 marks] Describe the impacts on agriculture and industry.

Heat, unreliable rainfall and floods reduce agricultural yields and rural income. Industry is affected when raw materials such as cotton become scarce, when electricity demand rises and when flooding disrupts factories and transport.

[4 marks] Explain how climate change affects agriculture.

Heatwaves increase crop evaporation and can reduce photosynthesis or grain filling. Drought then restricts irrigation water, while intense flooding can destroy fields and irrigation channels, lowering harvests and farmers' incomes.

[5 marks] Assess the impact of climate change on Pakistan's economy.

Pakistan's economy is exposed because agriculture, textile production and transport are climate-sensitive. Floods and drought reduce food and cotton output, raise prices and can interrupt industrial supply chains. Resilience investments reduce losses, but poorer farming communities remain exposed. The relative burden varies by sector and region.

[8 marks] 'Climate change has a greater impact on agriculture than industry.' How far do you agree?

Agriculture depends directly on rainfall, temperature and irrigation, so drought, heatwaves and the 2022 floods can reduce food and cotton harvests and rural incomes. Industry is also affected: textile factories require reliable cotton, electricity and road access, while floods can directly damage machinery and interrupt exports. Some industrial businesses may adapt through diversified supplies and stronger infrastructure, but small factories often cannot afford these measures. Agriculture may experience more direct weather-related production losses, especially in rain-fed districts, while industrial and national economic losses can be equally important through supply-chain disruption. The two sectors are interconnected rather than independent.

UNIT 1.3.3

PAKISTAN'S RESPONSE TO CLIMATE CHANGE

UNIT 1.3.3

A-AGREEMENTS

[1 mark] What is meant by the Paris Agreement?

The international climate agreement adopted in 2015, aiming to keep global warming well below 2°C and pursue efforts to limit it to 1.5°C.

[1 mark] What are Nationally Determined Contributions (NDCs)?

National climate action plans through which countries set out planned emissions reductions and adaptation measures under the Paris Agreement.

[2 marks] State two aims of Pakistan's National Climate Change Policy.

To improve adaptation and resilience to climate risks and to promote measures that reduce greenhouse-gas emissions.

[3 marks] Describe the main features of the National Adaptation Plan (NAP).

Pakistan's National Adaptation Plan 2023 identifies climate risks and adaptation priorities, including water management, agriculture, resilient infrastructure, ecosystems and support for vulnerable communities. It encourages coordinated action and investment.

[4 marks] Explain how the Paris Agreement helps reduce global emissions.

The Paris Agreement asks countries to submit and update progressively stronger NDCs and report progress, creating common goals and transparency. International cooperation can also mobilise finance and technology, although countries must implement domestic measures for emissions to fall.

[5 marks] Assess the importance of international agreements for Pakistan.

International agreements establish shared goals, reporting arrangements and opportunities for climate finance or technical support, all important to climate-vulnerable Pakistan. However, actual flood protection, irrigation improvement and resilient housing depend on domestic policy, funding and local implementation. Agreements are valuable frameworks rather than complete solutions.

[8 marks] 'International agreements are the most effective way to tackle climate change.' How far do you agree? Give reasons and examples.

International agreements such as the Paris Agreement coordinate global mitigation and ask countries to submit and update NDCs, creating a framework for emissions reductions. They also support climate finance, adaptation cooperation and technological exchange that can help Pakistan. Nevertheless, global commitments are only effective when countries deliver real emissions cuts; Pakistan cannot wait for international action before protecting exposed floodplains and water supplies. Projects such as Recharge Pakistan and afforestation can reduce local vulnerability, although they require sustained investment. International agreements are essential for tackling the global causes of warming, but effective action also depends on strong national and community-level adaptation.

B-NATIONAL POLICIES (I). AFFORESTATION / REFORESTATION

[1 mark] What is meant by afforestation?

Planting trees on land that has not recently been forested.

[1 mark] What is meant by reforestation?

Re-establishing forest cover on land that was previously forested.

[2 marks] State two benefits of afforestation.

Carbon uptake from the atmosphere and reduced soil erosion through roots and vegetation cover.

[2 marks] Name two afforestation initiatives undertaken in Pakistan.

The Billion Tree Tsunami initiative in Khyber Pakhtunkhwa and the Ten Billion Tree Tsunami Programme at national level.

[3 marks] Describe three environmental benefits of afforestation.

Trees absorb CO₂ during growth, stabilise soil with their roots and provide habitat for wildlife. Canopy and leaf litter can also improve infiltration and reduce rapid runoff.

[3 marks] Describe how reforestation can improve soil quality.

Fallen leaves add organic matter, supporting soil organisms and improving soil structure. Tree roots help bind the soil and create pathways for infiltration, reducing erosion and helping restore degraded land.

[4 marks] Explain how afforestation helps reduce the risk of flooding.

Tree canopies intercept some rainfall and roots improve soil infiltration, reducing the speed of surface runoff. On hillsides, root systems stabilise slopes and slow soil erosion, which can lessen some flash-flood effects downstream.

[4 marks] Explain how afforestation contributes to the conservation of biodiversity.

New forest and habitat corridors provide food, nesting sites and shelter for birds, insects and mammals. Replanting native species can reconnect fragmented habitats and restore a more diverse ecosystem.

[5 marks] Assess the importance of afforestation in reducing the impacts of climate change in Pakistan.

Afforestation can absorb CO₂, stabilise degraded soil and moderate some local flood risks, especially in upland catchments. Planting and maintenance can also generate jobs. However, trees take years to grow, survival may be low without care and poorly chosen species can consume scarce water. Programmes matter most when native trees survive and forests are protected long term.

[8 marks] Evaluate the success of afforestation and reforestation programmes in promoting sustainable development in Pakistan.

Afforestation and reforestation can improve soil stability, wildlife habitat and long-term carbon storage, while employing local nursery and planting workers. In the Ten Billion Tree Tsunami Programme, restoration is targeted at areas including KP hillsides and Sindh mangroves. Yet seedling counts alone do not establish success: tree survival, native species selection, biodiversity and water availability determine actual outcomes. Extreme drought, grazing and illegal cutting can undo initial gains. These programmes can contribute meaningfully to sustainable development when monitored and combined with community forest protection, but they cannot replace fossil-fuel emissions cuts or wider adaptation.

B-NATIONAL POLICIES (II). RENEWABLE ENERGY**[1 mark] What is meant by renewable energy?**

Energy that is replenished naturally on human timescales, such as solar, wind and flowing-water energy.

Name one renewable energy source used in Pakistan.

Solar power.

[2 marks] State two advantages of renewable energy.

Lower direct operational greenhouse-gas emissions and reduced reliance on imported fossil fuels.

[2 marks] Name two forms of renewable energy that have potential in Pakistan.

Solar power and wind power.

[3 marks] Describe three benefits of using renewable energy.

Renewables can reduce CO₂ emissions during electricity generation, diversify energy supplies and improve electricity access in sunny or windy areas. They can also reduce expenditure on imported fuels over time.

[3 marks] Describe the role of solar energy in Pakistan's energy supply.

Solar panels convert sunlight into electricity and can supply rooftops, schools, farms or larger solar parks. Pakistan's sunny lowland regions offer strong potential, though output varies with sunshine and requires suitable grid or storage arrangements.

[4 marks] Explain how renewable energy can reduce Pakistan's dependence on fossil fuels.

Solar and wind power generate electricity without burning coal, oil or gas, displacing some imported fossil-fuel consumption. A more diverse supply mix also makes Pakistan less exposed to international fuel-price shocks, provided the grid can manage variable generation.

[4 marks] Explain how greater use of renewable energy can support economic development in Pakistan.

Increasing domestic solar and wind generation can reduce import bills and create installation, maintenance and manufacturing opportunities. More reliable and affordable electricity can improve farm irrigation and industrial productivity, although grid and storage investment is needed.

[5 marks] Assess the effectiveness of renewable energy projects in addressing Pakistan's energy needs.

Renewables such as the Jhimpir wind corridor and solar installations can lower reliance on imported fuels and cut operational emissions. However, solar and wind output varies, and integration requires transmission, backup or storage. Hydropower is established but vulnerable to seasonal water availability. Renewables can address part of Pakistan's energy needs, but a balanced and reliable electricity system is required.

[8 marks] 'Renewable energy is the best solution to Pakistan's energy crisis.' How far do you agree? Give reasons and examples.

Renewable energy offers Pakistan domestic solar and wind resources, lower operational CO₂ emissions and less exposure to imported fossil-fuel prices. Solar installations and Jhimpir wind farms show the opportunities, while decentralised solar power can serve areas poorly connected to the grid. However, variable output, storage costs and weak transmission limit how quickly these sources can replace dispatchable generation. Hydropower also varies seasonally and large projects may have environmental costs. Pakistan should increase renewables substantially, but reliability, affordability and grid investment matter as much as the proportion of energy classified as renewable.

B-NATIONAL POLICIES (III). REDUCING GHG EMISSIONS

[8 marks] 'Reducing greenhouse gas emissions is more important than adaptation strategies.' How far do you agree? Give reasons and examples.

Mitigation lowers greenhouse-gas emissions that drive future warming, and Pakistan can contribute through renewable energy, forest protection and efficient transport. However, even strong global

mitigation cannot immediately prevent floods, heatwaves or glacier hazards already facing Pakistan. Adaptation through early warning, resilient agriculture and wetland restoration therefore protects lives and livelihoods now. Given Pakistan's relatively small contribution to historical global emissions but high exposure to climate risks, adaptation is urgently important domestically, while global mitigation remains indispensable for limiting long-term damage. Neither strategy is sufficient on its own.

C-ADAPTATION STRATEGIES (I). CYCLONE / FLOOD RISK MANAGEMENT

[5 marks] Assess the effectiveness of flood and cyclone management strategies.

Flood forecasting and evacuation reduce deaths, while embankments and improved urban drainage protect some settlements. Mangrove or wetland restoration can store water and buffer coastal storms, but extreme rainfall may exceed the design of any single measure. A combination of preparedness, well-maintained defences and careful land-use planning is most dependable.

[8 marks] 'Flood management is the most important climate adaptation strategy.' How far do you agree? Give reasons and examples.

Flood management directly protects Pakistan's exposed Indus floodplain communities through early warnings, wetland restoration, drainage and carefully sited embankments. The 2022 floods show the need for better preparedness. Yet drought-resistant agriculture, heatwave response and coastal protection are equally important in other regions, including Tharparkar and the Indus Delta. The most important adaptation measure depends on the location and hazard faced. Flood management is a major national priority but should form part of broader climate resilience rather than displace adaptation for drought, heat and water scarcity.

C-ADAPTATION STRATEGIES (II). INCREASING CROP RESILIENCE

[1 mark] What is crop resilience?

The ability of a crop to maintain growth and useful yields despite stresses such as drought, heat or floods.

[1 mark] Name one drought-resistant crop.

Sorghum, which is relatively drought tolerant.

[2 marks] State two ways farmers adapt to climate change.

Farmers can plant drought-tolerant varieties and adopt efficient drip or sprinkler irrigation.

[2 marks] Give two effects of drought on crops.

Water shortage reduces germination and grain filling, while heat and drought stress lower overall crop yield.

[3 marks] Describe how farmers adapt to climate change.

Farmers can plant heat- or drought-tolerant crop varieties, conserve soil moisture through mulching and improve irrigation efficiency. They may also adjust sowing dates to avoid peak heat or periods of unreliable rain.

[4 marks] Explain how irrigation improvements help farmers.

Drip and sprinkler irrigation deliver water more precisely and reduce conveyance or field losses compared with poorly managed flood irrigation. Reliable moisture reduces drought stress and helps crops maintain yields with less water.

[5 marks] Assess the importance of crop resilience in Pakistan.

Crop resilience helps reduce harvest failure and food-price volatility, especially in drought-prone or flood-exposed districts. Adapted seeds, efficient irrigation and extension advice can protect incomes. However, seed costs, limited finance and extreme hazards constrain results, so resilient crops must be combined with wider water and risk management.

[8 marks] 'Improving crop resilience is essential for Pakistan's food security.' How far do you agree? Give reasons and examples.

Drought-tolerant and heat-resilient crop varieties can help Pakistani farmers maintain output during increasingly variable weather. Efficient irrigation, better planting dates and soil management also reduce losses, particularly in water-stressed areas. However, seeds alone cannot overcome exhausted groundwater, catastrophic flooding or lack of farmer credit; some new varieties are costly or poorly suited to local conditions. Government support, reliable water and fair access to technology are necessary for widespread benefits. Crop resilience is an essential part of food security, but it needs to work alongside irrigation reform, storage, market access and broader climate adaptation.

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CASE STUDY: RESPONDING TO CLIMATE CHANGE**A. RECHARGE PAKISTAN PROJECT (ADAPTATION STRATEGY)****[1 mark] What is meant by climate change adaptation?**

Actions taken to reduce harm from current or expected climate impacts, for example flood protection and drought-resilient farming.

[1 mark] Name the organisation leading the Recharge Pakistan Project.

WWF-Pakistan, working with government and other partners.

[2 marks] State two aims of the Recharge Pakistan Project.

To reduce flood risk by storing excess floodwater and to increase groundwater recharge and dry-season water security.

[2 marks] Name two target areas of the project.

Thatta and Badin districts in Sindh. Other areas named in the textbook include Dadu and Jacobabad.

[3 marks] Describe how Recharge Pakistan helps reduce flood risk.

Recharge Pakistan restores wetlands and reconnects rivers to floodplains so high flows can spread and slow rather than rush into settlements. Improved natural drainage reduces peak runoff, while local involvement supports long-term maintenance.

[3 marks] Describe how wetlands are used in the project.

Restored wetlands temporarily hold excess floodwater and slow its movement. During drier periods stored water infiltrates into the ground, while restored habitat can support biodiversity and provide local ecosystem benefits.

[4 marks] Explain how restoring wetlands reduces flooding.

Wetlands absorb and temporarily store excess floodwater, reducing peak flow towards homes and farms. Reconnecting rivers to floodplains spreads high flows over a larger area, lowering pressure on individual channels and settlements.

[4 marks] Explain how the project improves groundwater supply.

Water held in restored wetlands and floodplains infiltrates into permeable soils, replenishing underground aquifers. Improved natural drainage can reduce rapid runoff so more water soaks into the ground for later well and irrigation use.

[5 marks] Assess the advantages of the Recharge Pakistan Project for local communities.

Recharge Pakistan can protect settlements and crops, improve groundwater supplies and restore wildlife habitat across the Indus floodplain and delta. Local participation and lower long-term maintenance costs are further benefits. However, land is needed and restoration takes time; severe floods may still overwhelm the natural storage available.

[8 marks] 'Recharge Pakistan is a cost-effective long-term solution for Pakistan.' How far do you agree? Give reasons and examples.

Recharge Pakistan uses wetland restoration, floodplain reconnection and groundwater recharge to address flood and water-security risks in districts including Thatta, Badin, Dadu and Jacobabad. These approaches may protect farms, increase dry-season water availability and improve biodiversity at lower long-term maintenance cost than some large structures. Yet they need land, community

consent, continuing management and time for ecosystems to recover, extreme floods can still exceed their capacity. A hybrid approach that combines restoration with early warning and targeted embankments is likely to be more resilient. Recharge Pakistan has credible long-term benefits, but success must be judged through measured flood-loss reduction, groundwater recovery and local livelihoods rather than its design alone.

B. RECHARGE PAKISTAN – ADVANTAGES & DISADVANTAGES

[1 mark] Name one advantage of the Recharge Pakistan Project.

Reduced flood risk for nearby farms and settlements.

[1 mark] Name one disadvantage of the project.

Wetland restoration takes time and may require land currently used for farming or housing.

[2 marks] State two environmental benefits of restoring wetlands.

Wetlands store and slow floodwater, and they provide habitat for birds, fish and other wildlife.

[3 marks] Describe the environmental benefits of wetlands restoration.

Wetland restoration can increase biodiversity through new aquatic and riparian habitats, improve water quality by trapping some sediment and nutrients, and slow flood runoff while supporting groundwater recharge.

[3 marks] Describe the challenges faced in implementing the project.

Implementing Recharge Pakistan requires suitable floodplain land, agreement with land users and coordination across communities and irrigation agencies. Wetland recovery takes time, ongoing monitoring is necessary and extreme rainfall may still cause flooding.

[8 marks] 'Nature-based solutions are more sustainable than engineering solutions.' How far do you agree? Use the Recharge Pakistan example.

Nature-based measures such as Recharge Pakistan can store floodwater, recharge groundwater and restore biodiversity simultaneously, often with relatively low long-term maintenance costs. However, floodplain restoration requires space and community agreement, and its capacity can be exceeded during extreme events. Engineering works such as embankments offer more immediate protection for tightly built settlements but can fail, transfer risk downstream or damage natural habitats. A combination is often most sustainable: restored wetlands manage routine high flows and support ecosystems, while targeted, maintained defences protect critical infrastructure.

C. TEN BILLION TREE TSUNAMI PROGRAMME (MITIGATION STRATEGY)

[1 mark] What is meant by a mitigation strategy?

An action intended to reduce greenhouse-gas emissions or increase carbon sinks so future warming is limited.

[1 mark] Name one aim of the Ten Billion Tree Tsunami Programme.

To expand forest cover and increase the absorption of atmospheric CO₂.

[2 marks] State two aims of the programme.

To increase tree cover and carbon storage, and to restore degraded land or protect biodiversity.

[2 marks] Name two areas where tree plantation is carried out.

Swat in Khyber Pakhtunkhwa and mangrove planting areas around Thatta in Sindh.

[3 marks] Describe how forests improve environmental quality.

Trees absorb atmospheric CO₂, shelter wildlife and stabilise soil. Root systems can help maintain

infiltration and canopy cover can moderate local temperatures and surface runoff.

[4 marks] Explain how forests reduce soil erosion and flooding.

Roots bind hillside soils, reducing erosion, while leaves and vegetation slow rainfall and allow more infiltration. These processes can reduce the speed and sediment content of runoff, lowering some local flood risk.

[5 marks] Assess the importance of the Ten Billion Tree Tsunami Programme for Pakistan.

The programme can restore degraded forests, absorb carbon, protect habitats and create rural nursery and planting employment, with activity in KP and Sindh mangrove zones. However, seedling survival, native species and protection from grazing determine lasting success; planting targets alone are not sufficient evidence of impact.

[8 marks] 'The Ten Billion Tree Tsunami Programme is a sustainable response to climate change.' How far do you agree? Give reasons and examples.

The Ten Billion Tree Tsunami Programme seeks to increase forest cover, carbon storage, biodiversity and rural employment through planting, reforestation and natural regeneration. Target areas in KP and Sindh illustrate how the same programme can protect hill soils and restore coastal mangroves. Nevertheless, seedlings may fail in drought, grazing and illegal cutting can reverse gains, and trees need years to store substantial carbon. Genuine success depends on survival, biodiversity improvement and effective community stewardship rather than planting totals. The programme can be a sustainable contribution to climate mitigation and local adaptation, but it should complement rather than replace reductions in fossil-fuel emissions.

D. TBTPP – ADVANTAGES & DISADVANTAGES

[1 mark] Name one benefit of tree planting.

Absorbing atmospheric CO₂ as trees grow.

[1 mark] Name one limitation of the programme.

Low seedling survival where drought, grazing or poor maintenance prevent establishment.

[3 marks] Describe the economic benefits of tree planting.

Nurseries, planting teams and monitoring create rural jobs, while healthier forests can protect water and soil resources used by farms. Restored forests may also support ecotourism and sustainable forest products where managed appropriately.

[4 marks] Explain why tree plantation takes time to be effective.

Young seedlings absorb relatively little carbon until they grow, so large climate benefits take years or decades. Some planting sites also need prolonged watering, protection from grazing and replacement of dead trees before stable forest cover develops.

[8 marks] "Tree planting alone is enough to control climate change in Pakistan." How far do you agree? Give reasons and examples.

Trees absorb CO₂ and improve soil, habitat and local water management, but Pakistan also faces substantial fossil-fuel emissions, floods and heatwaves that plantations alone cannot prevent. Seedling survival is uncertain, and forest ecosystems take years to mature. Effective climate policy therefore combines protection of existing forests and suitable replanting with renewable electricity, efficient transport, flood management and resilient agriculture. Tree planting is a valuable supporting measure, not a complete response to climate change.

E. SUSTAINABLE DEVELOPMENT (BOTH CASE STUDIES)

[1 mark] What is sustainable development?

Development that meets present needs without undermining future generations' ability to meet theirs.

[1 mark] Name one way these projects support sustainability.

Restoring wetlands and forest ecosystems so they can continue providing benefits over time.

[2 marks] State two ways these projects support sustainable development.

Recharge Pakistan can protect water supplies and reduce flood losses; the tree programme can restore forests and carbon storage while supporting rural employment.

[3 marks] Describe how these projects improve environmental quality.

Recharge Pakistan can restore wetland biodiversity and improve groundwater recharge. Tree restoration can improve habitat, reduce erosion and store more carbon as forests mature.

[4 marks] Explain how these projects support long-term development.

Recharge Pakistan can reduce recurring flood damage and improve dependable water supplies for farming. Reforestation supports long-term soil conservation and carbon storage while creating local employment; both protect productive natural resources for future generations.

[5 marks] Assess the importance of sustainable development in climate change responses.

Sustainable development provides a useful test of climate projects: they should lower hazards while maintaining livelihoods, biodiversity and future resource supplies. Recharge Pakistan can store floodwater and support aquifers, while tree restoration can stabilise soil and absorb carbon. However, both require community consent, funding, maintenance and evidence that benefits persist. Strong monitoring should consider economic, social and ecological outcomes.

[8 marks] "Sustainable development is the most important goal of climate change strategies." How far do you agree? Give reasons and examples.

Sustainable development requires climate action that protects present livelihoods without degrading the natural resources future generations will need. Recharge Pakistan can reduce flood damage, recharge aquifers and restore wetlands, while the Ten Billion Tree Tsunami Programme seeks to store carbon, protect habitat and create rural employment. Nevertheless, the success of either depends on long-term management: floodplains need land and cooperation, and plantations need high tree survival. Short-term engineered protection may still be necessary around critical infrastructure. Sustainability is a valuable overarching goal, but it should be judged using measured reductions in risk, restored ecosystems and equitable local benefits rather than project labels alone.

F. DECISION- MAKING / CASE STUDY APPLICATION

[1 mark] Name one flood- prone area in Pakistan.

Dadu district in Sindh.

[1 mark] Name one method of flood control.

Wetland restoration.

[2 marks] State two benefits of wetlands restoration.

Stored floodwater reduces peak flow, and restored habitats help support biodiversity and improve some water-quality processes.

[3 marks] Describe how floodplains help reduce flood damage.

Floodplains spread high river flows over a wider area, temporarily storing water and lowering flood peaks. When the flow recedes, water can infiltrate to replenish soil and groundwater, reducing pressure on downstream settlements.

[3 marks] Describe how tree planting improves local environments.

Tree roots stabilise soil and reduce erosion; foliage provides shade and habitat while growing trees absorb CO₂. Better vegetation cover can also slow runoff and support local biodiversity.

[4 marks] Explain why floodplain restoration may be preferred over embankments.

Floodplain restoration spreads and stores floodwater while potentially recharging groundwater and restoring habitat. Embankments may offer rapid protection to dense settlements, but can prevent natural overflow, concentrate water and fail during extreme events. Restoration is preferable where land and local agreement are available, while strategic embankments remain useful for critical infrastructure.

[5 marks] Assess which strategy (mitigation or adaptation) is more effective in Pakistan.

For Pakistan, mitigation through lower emissions is essential to limiting future warming, but adaptation provides immediate protection against floods, drought and heat that are already affecting communities. Recharge Pakistan illustrates near-term flood and water-security gains from adaptation, while forest restoration can both store carbon and reduce erosion. Pakistan's relatively small historical emissions do not lessen its interest in global mitigation, but local adaptation should be a major immediate investment where exposure is high. Neither is universally more effective: effectiveness depends on whether the objective is near-term protection or limiting longer-term global warming.

[8 marks] A flood-prone district has limited funds. Should it prioritise (a) embankments or (b) wetland restoration? Give reasons for your choice and one disadvantage.

A flood-prone district with limited funds could prioritise wetland restoration where suitable floodplain land is available, because restored wetlands store water, slow peak flows, recharge aquifers and support biodiversity at relatively modest long-term maintenance cost. Recharge Pakistan offers an example of this approach. However, a densely built town beside a river may need properly engineered embankments to protect homes and hospitals quickly; wetlands need space and cannot stop every extreme flood. The district should therefore assess settlement density, available land and flood levels. Wetland restoration is a strong long-term priority where feasible, complemented by targeted embankments, flood warning and evacuation plans rather than treated as an absolute alternative.