Singapore Examinations and Assessment Board

Cambridge Assessment International Education

Singapore–Cambridge General Certificate of Education Advanced Level Higher 2 (2024)

Geography (Syllabus 9173)

(First year of examination in 2024)

CONTENTS

INTRODUCTION

The 2016 Charter drafted by the Commission on Geographical Education of the International Geographical Union (IGU) affirms the value and contribution of school Geography as a vital subject for 21st century citizens living in a tightly connected world. It also enables students to think critically about what it means to live sustainably in this world.

At all levels of study, Geography bridges the humanities, social and natural sciences. It is a holistic subject that provides students with integrative ways of understanding the real world. Students will explore Earth, its natural and man-made environments and examine human interactions with these environments, from personal to global scales. Geography fascinates and inspires students, enabling them to gain a deep appreciation of Earth's beauty, the immense power of natural forces, and ingenious ways humans thrive under different circumstances. Through Geography, students will understand how places and landscapes evolve, deliberate on consequences arising from our everyday decisions, and experience the mosaic of cultures and societies.

Fieldwork satisfies and nourishes students' curiosity of contemporary issues that affect their communities. Building on their classroom learning and equipped with essential fieldwork skills, students hone their abilities to generate knowledge, creatively solve problems, and contribute towards making their world a better place. Such learning experiences in Geography enables students living in an interconnected world to discover what it means to live sustainably and exist harmoniously with one another, as well as all other living species.

Desired Outcomes of Education and 21st Century Competencies

Overarching educational outcomes can be achieved effectively through a purposeful study of established subjects like Geography. The Geography syllabus aims to enable students to have the following attributes upon the completion of their formal education. He/she should be a/an:

1. ***confident person*** who has a strong sense of right and wrong, is adaptable and resilient, knows himself/herself, is discerning in judgement, thinks independently and critically, and communicates effectively

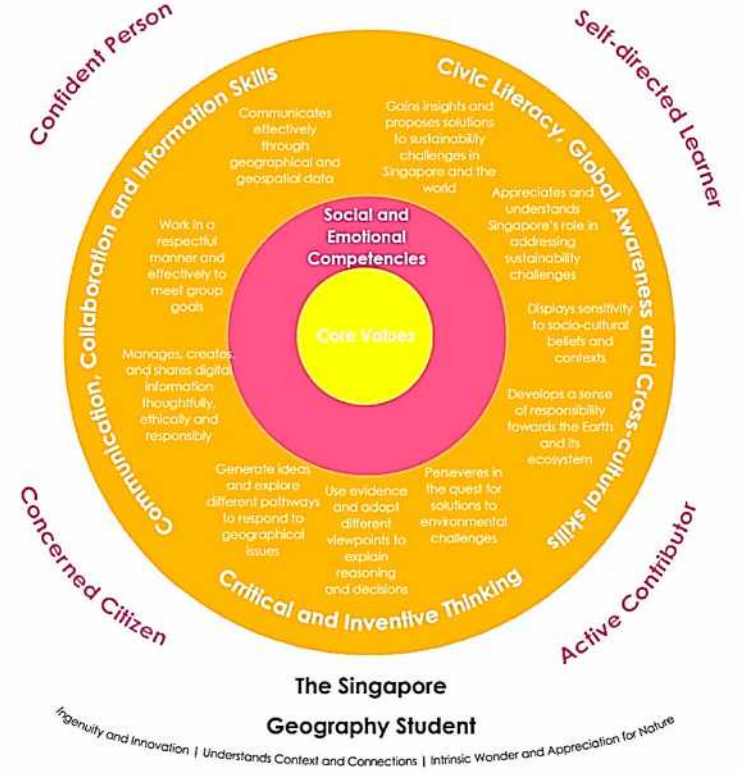
2. ***self-directed learner*** who questions, reflects, perseveres and takes responsibility for his/her own learning

3. ***active contributor*** who is able to work effectively in teams, is innovative, exercises initiative, takes calculated risks and strives for excellence

4. ***concerned citizen*** who is rooted to Singapore, has a strong sense of civic responsibility, is informed about Singapore and the world, and takes an active part in bettering the lives of others around him/her.

Desired Outcomes of Education (DOE)

Figure 1: Geography Education and DOE



Geography supports the development of important competencies necessary for students to thrive in the 21st century (see Figure 1). Additionally, students will learn a range of life skills and develop key social and emotional competencies that will enable them to achieve personal mastery and relate to others. Most importantly, all learning must be anchored in core values (i.e., **Respect**, **Responsibility**, **Integrity**, **Care**, **Resilience and Harmony**). These values define a person's character and shape his/her beliefs, attitudes and actions.

Social and emotional competencies (i.e., self-awareness, self-management etc.) are skills necessary for students to recognise and manage their emotions, develop care and concern for others, make responsible decisions, establish positive relationships and handle challenging situations effectively. Emerging 21st Century Competencies (21CC) necessary for the globalised world we live in are Civic Literacy, Global Awareness and Cross-cultural Skills; Critical and Inventive Thinking; and Communication, Collaboration and Information Skills. These competencies will enable our students to tap into rich opportunities in the new digital age, while keeping a strong Singapore heartbeat.

The domains of the emerging 21CC are defined below.

Civic Literacy, Global Awareness and Cross-cultural Skills
Our society is becoming increasingly cosmopolitan and more Singaporeans live and work abroad. Our young will therefore need a broader worldview, and the ability to work with people from diverse cultural backgrounds, with different ideas and perspectives. At the same time, they should be informed about national issues, take pride in being Singaporean and contribute actively to the community.

Critical and Inventive Thinking
To be future-ready, our young need to be able to think critically, assess options and make sound decisions. They should have a desire to learn, explore and be prepared to think out of the box. They should not be afraid to make mistakes and face challenges that may at first appear daunting.

Communication, Collaboration and Information Skills
With the Internet revolution, information is just a click away. It is important that our young know what questions to ask, how to sieve information and extract that which is relevant and useful. At the same time, they need to be discerning so they can shield themselves from harm, while adopting ethical practices in cyberspace. The workplace of the 21st century requires our young to be able to work together in a respectful manner to share responsibilities and make decisions with one another to meet group goals. Importantly, they must be able to communicate their ideas clearly and effectively.

National Education
The syllabuses support National Education (NE) which aims to develop the dispositions of citizenship. A strong sense of belonging, reality and hope motivates our students to be active citizens and contribute to their immediate communities and the nation. Through the subject, students will learn to develop an appreciation for Singapore and the world they live in, show care and concern, and apply their geographical knowledge and skills to actively contribute towards a sustainable future.

Geographical Concepts

The H2 Geography syllabus is framed by four geographical concepts that reflect how geographers study the world. At the Pre-University level, students are expected to have a sophisticated understanding of these concepts and apply them to:

- inquire and describe the world we live in
- analyse issues, phenomena and human-nature relationships
- discuss global efforts to achieve sustainable development.

Table 1: The Four Geographical Concepts and Their Application at Pre-University Level

Geographical Concept	Application	Further Guidance
Space	Apply the concept of Space to analyse how physical and human phenomena are organised across the earth's surface across space and over time	• Geographers are particularly concerned about the spatial and temporal aspects of what we study. • Much attention is placed on the organisation of physical and human phenomena across space and their evolution over time. Location and distance are often understood in relative rather than absolute terms in this context. • An examination of spatial and temporal relations and patterns can yield significant insights and enrich our understanding of the environment and humans.
Place	Apply the concept of Place to analyse different locations locally and globally	• Places could refer to a specific point or bounded territory on a map. Moreover, places are constantly evolving, fluid and contested by social processes. • Places are socially constructed as different people and groups associate subjective meanings to their experience of place. • Places are constructed and reconstructed as the result of processes that are simultaneously global and local.

Geographical Concept	Application	Further Guidance
Environment	Apply the concept of Environment as a system to analyse interrelationships between physical and human phenomena	• Our environment comprises both human and natural systems. Human-nature interactions are dynamic and complex, with changes in one part affecting other parts. • Systems are hierarchical, with the whole system at one level being a component of a higher-order set, while the elements of one system are in effect smaller-scale systems. • Positive feedback results in a net change in the system while a negative feedback does the opposite.
Scale	Apply the concept of Scale to analyse physical and human phenomena at different levels of interactions	• In physical geography, scale is often referred to as the resolution of a fieldwork or study. In human geography, common scales of analysis include local, national and global. • Issues and phenomena manifest at different scales from the personal to the global. • Processes also operate at different scales, with some operating on multiple scales at the same time. Processes at one scale can be amplified or diminished through interaction with other processes from any other scale.

AIMS AND LEARNING OUTCOMES

The aims and learning outcomes below represent the body of geographical knowledge, skills and values that students will acquire through H2 Geography.

Knowledge
The syllabus requires students to develop an understanding of:

- the uniqueness of places
- the dynamic and complex interactions and interdependence between natural environments and human environments at various scales
- the evolution of landscapes and development of issues over time
- the processes that shape spaces, places and the environment at various scales
- the connections, trends and patterns in different parts of Asia and the rest of the world
- a range of contemporary issues in different parts of Asia and the rest of the world through geographical perspectives
- knowledge from different subfields of geography to understand different approaches to solve real-world problems and achieve sustainable development.

Skills
The syllabus seeks to equip students with the ability to:

- consider evidence and different viewpoints to develop logical arguments and explanations
- analyse, evaluate and reflect on information from a geographical perspective to make informed and sound decisions
- construct understanding through inquiry using different data collection and analysis methods
- use and evaluate data representation techniques to communicate findings.

Values
The syllabus seeks to encourage students to:

- be inspired by the splendour of natural environments and human ingenuity
- care for delicate ecosystems and understand the importance of environmentally sustainable lifestyles
- develop as global citizens, seek harmony and respect others in a culturally diverse world
- contribute responsibly towards the building of a robust and inclusive society.

ASSESSMENT OBJECTIVES

AO1 – Knowledge with Understanding
Candidates should be able to demonstrate knowledge and understanding of: (a) geographical terms, facts, concepts, issues, phenomena and trends (b) geographical skills and methods to carry out fieldwork.
AO2 – Analysis
Candidates should be able to apply understanding of geographical knowledge to: (a) analyse issues, phenomena and trends presented in given data (b) analyse fieldwork in terms of data collected and methods used to collect and present data.
AO3 – Evaluation
Candidates should be able to carry out analysis to: (a) make judgements, recommendations, decisions and draw conclusions through synthesising geographical knowledge and assessing evidence, viewpoints, interests of different stakeholders and/or elements of an issue (b) evaluate the validity of fieldwork in terms of data collected and methods used to collect and present data.

EXAMINATION FORMAT

Paper 1 100 marks; 3h; 50%	**Paper 2** 90 marks; 3h; 50%
Section A: Structured Question (60 marks) Two compulsory questions will be set. Cluster 1: Question 1 Cluster 2: Question 2 Each question: • carries 30 marks • comprises no more than 6 sub-parts • may be on specific topic or combination of topics within the cluster **Section B: Essay (40 marks)** Four evaluative questions will be set. Candidates answer TWO questions, one from each cluster. Cluster 1 – EITHER Question 3 OR Question 4 Cluster 2 – EITHER Question 5 OR Question 6 Each question: • carries 20 marks • is assessed using generic level descriptors There will be a **maximum of 9 resources** in this paper.	**Section A: Structured Question (40 marks)** One compulsory fieldwork question will be set. Cluster 4: Question 1 Question: • carries 40 marks • comprises no more than 8 sub-parts • includes a 10-mark evaluative sub-part assessed using generic level descriptors **Section B: Structured Question (30 marks)** One compulsory question will be set. Cluster 3: Question 2 Question: • carries 30 marks • comprises no more than 6 sub-parts • may be on specific topic or combination of topics within Cluster 3. **Section C: Essay (20 marks)** Two evaluative questions will be set. Candidates answer ONE question. Cluster 3: EITHER Question 3 OR Question 4 Each question: • carries 20 marks • is assessed using generic level descriptors There will be a **maximum of 9 resources** in this paper.

ASSESSMENT SPECIFICATION GRID

Approximate Weighting of Assessment Objectives

Assessment Objectives	Paper 1 (marks)	Paper 2 (marks)	Total (marks)	Total (Weighting %)
AO1	20	25	45	24
AO2	40	35	75	39
AO3	40	30	70	37
Total	100	90	190	100

SYLLABUS CONTENT

CLUSTER 1: DEVELOPMENT, ECONOMY AND ENVIRONMENT

Topic 1.1 Environment and Resources

Why is the environment important for sustainable development?

In 2015, governments adopted the Sustainable Development Goals, broadening the definition of development to encompass economic, environmental and social dimensions. This shift highlights the importance of the natural environment as a provider for human activities and an absorber of human wastes. Given the limitation of the natural environment's ability to meet present and future needs, it is important that we manage natural resources sustainably.

In this topic, students will first develop an understanding of sustainable development, which is the foundational concept of this syllabus. They will then explore the importance of the environment and factors influencing our resource supply. The study of Thomas Malthus' and Ester Boserup's ideas will facilitate students' evaluation of whether there are adequate resources to support the needs of our growing population. They will also explore the management of renewable energy, transboundary water resources, and extraction of non-renewable resources.

Key Question	**Content**
	Students will understand:
1. Understanding Sustainable Development	
What is sustainable development?	• The concept of sustainable development, as defined in 'Our Common Future': – the meeting of present and future needs, in particular the essential needs of the poor – the maximising of goals across economic, environmental and social dimensions • The interdependence between economic, environmental and social dimensions • The possible trade-offs between economic, environmental and social dimensions • Limits on ability to meet present and future needs imposed by: – current level of technology – the environment's ability to meet those needs
How do we know that there is progress towards sustainable development?	• Ways to progress towards sustainable development, as defined by the Sustainable Development Goals (SDGs): – economic growth – environmental protection – social inclusion • Use of quantitative targets and indicators to measure: – economic growth – environmental protection – social inclusion • The difficulty of measuring progress towards sustainable development using quantitative indicators due to the lack of capacity of some countries to collect data

Key Question	Content
	Students will understand:
What are the challenges that might limit the progress towards sustainable development?	• Challenges limiting the progress towards sustainable development: – economic challenges – political challenges
2. Environment and Resources	
Why is the environment important?	• The importance of ecosystem services provided by the environment: – provisioning services – regulating services – cultural services – support services • Variations over time and space of what is considered a provisioning service due to: – demand for the provisioning service – technology • Human activities which can compromise the ability of the environment to provide ecosystem services: – destruction of habitats – pollution of natural environment – introduction of invasive species
Will our supply of provisioning services ever be depleted?	• Classification of provisioning services based on their renewability: – renewable resources – non-renewable resources • The impact on supply of renewable resources when their regenerative capacity is exceeded • Classification of provisioning services based on their availability: – proven reserves – conditional reserves – hypothetical reserves – speculative reserves
Are there adequate provisioning services to support population growth?	• Thomas Malthus' views on limit imposed by the natural environment on population numbers • Ester Boserup's views on role of technology in expanding resource base • Limitations to Thomas Malthus' and Ester Boserup's views: – Malthus' lack of credit to human inventiveness – Boserup's lack of consideration of degradation of the resource base because of technological innovations • Malthus' and Boserup's lack of consideration of unevenness in access to resources across the population

Key Questions	Content
	Students will understand:
3. Managing Resources	
How do we manage the use of renewable energy sources?	• Potential of solar power and hydropower to reduce dependence on fossil fuels as energy sources • Limitations of solar power and hydropower in providing energy security • Trade-offs associated with solar power and hydropower: – economic considerations – environmental considerations – social considerations
How do we manage conflicts over transboundary water resources?	• Transboundary nature of rivers that are shared by multiple countries • Conflicts between countries sharing transboundary water resources due to negative impacts of the actions of one country on another • Varying success of strategies to manage conflicts over transboundary water resources
How do we manage the extraction of non-renewable resources by the extractive industries?	• Characteristics of extractive industries: – extraction of non-renewable and locationally specific resources – capital and technology intensive – dominated by large private and state-owned firms • Variations in impacts of extractive industries between places – economic impacts – environmental impacts – social impacts • Varying success of strategies to manage impacts of extractive industries on places

Topic 1.2 Development and the Global Economy

How does the global economy impact places?

The global economy is complex, characterised by dynamic geographies and interactions between multiple actors at different scales. The global economy connects places at different scales and creates interdependence between them. An understanding of how the global economy works is key in building students' ability to examine the relationship between people and the economy.

In this topic, students will develop an understanding of the global economy. After acquiring an understanding of the current state of development across the world, students will learn about the geographical patterns of trade, investment and labour flows in the global economy. The unevenness in the flows will contribute to students' understanding of how the global economy can result in variations in development levels. Students will continue to build their understanding of economic configuration using the global production network framework. Studying the interactions between different actors will help students understand the relative influence of each actor in the global economy.

Key Questions	**Content**
	Students will understand:
1. Development	
How do levels of development vary across space?	• Variations across space in levels of development between: – macro-regions – countries within a macro-region – different places within a country
How are global patterns of trade, capital and labour flows related to variations in levels of development across space?	• Global patterns of flows of trade, capital and labour: – unevenness across space – shifts since the 1950s • Influence of global patterns of flows of trade, capital and labour on variations in levels of development across space • Influence of variations in levels of development across space on global patterns of flows of trade, capital and labour
How might the structure of a country's economy be affected by shifts in global patterns of manufacturing, services and agriculture?	• The shifts in the global patterns of production in manufacturing, services and agriculture since the 1950s and their impact on a country's economy: – likely shift towards the manufacturing sector and a decrease in the share of agricultural sector for some countries – likely shift towards the service sector for countries at higher levels of development as the competitiveness of their manufacturing sector declines

Key Questions	Content
	Students will understand:
2. Geography of the Global Economy and Transnational Corporations (TNCs)	
How do global patterns of flows of trade, capital and labour illustrate the interconnectedness within the global economy?	• The connections between places through trade, capital and labour flows • The interdependence between places in the global economy as a result of trade, capital and labour flows
How do the global production networks of TNCs connect places within the global economy?	• Ways by which Global Production Networks (GPNs) of TNCs connect places within the global economy through flows of materials and capital: – sourcing of inputs from different places – transformation of inputs into products at different places – distribution of products to different places – consumption of products in different places
How do TNCs' global production networks impact their home and host economies?	• Positive and negative impacts of GPNs of TNCs on host and home economies: – economic impacts – environmental impacts – social impacts
3. Relative Influence of Actors in Shaping the Global Economy	
Can states influence economic activities?	• Influence of states on TNCs' operations through their role as regulators of economic activities • Varying degree of states' influence over the operations of TNCs
Can labour influence economic activities?	• Influence of labour characteristics on TNCs' locational decisions • Influence of labour unions on TNCs and states • Influence of TNCs and states on labour: – regulation of labour by states – impact of TNCs' decisions on labour
Can multilateral institutions influence economic activities?	• Influence of multilateral institutions on TNCs and states: – Association of Southeast Asian Nations (ASEAN) – World Trade Organisation (WTO) – World Bank

CLUSTER 2: TROPICAL ENVIRONMENTS

Topic 2.1 Tropical Climates and Drainage Basins

What are the interrelationships between climatic and hydrological systems in the tropics?

Physical geographers today focus on the diverse natural environment. Modern physical geography aims to explain the spatial patterns in the environment, the underlying dynamics and processes underpinning them at different scales. Popular among physical geographers is the systems approach, which examines the interrelationships between different components in the environment.

In this topic, students will examine climatic and hydrological systems, with a focus on the tropics. Students will first study the temperature and rainfall characteristics of different climate zones in the tropics and understand how the climate zones are influenced by circulations at the global and synoptic scales. They will then explore how climate influences the balance between input and output of moisture in drainage basin systems. They will also learn how water moves and is stored in drainage basin systems. An understanding of climatic and hydrological systems enables students to then examine flooding in the humid tropics.

Key Question	**Content**
	Students will understand that:
1. Tropical Climates	
What are the similarities and differences in the temperature and rainfall patterns in the tropics?	• Classification of locations in the tropics into climate zones according to their temperature and rainfall characteristics: – humid tropics: tropical rainforest (Af), tropical monsoon (Am), tropical savanna (Aw) – arid tropics: sub-tropical steppe (BSh), tropical desert (BWh) • High temperatures as the key distinguishing characteristic of the tropics • Variations in amount of rainfall between the humid and arid tropics • Seasonal variations in rainfall patterns in different parts of the tropics
How does global atmospheric circulation affect rainfall in the tropics?	• Effect of high angle of incidence on surplus heat and temperature in the tropics • Role of surplus heat in driving atmospheric circulation in the Hadley cells • Influence of atmospheric circulation in the Hadley cells on rainfall patterns in the tropics • Influence of seasonal migration of the Hadley cells on rainfall patterns in the tropics
How does synoptic scale circulation affect rainfall in the tropics?	• Influence of distribution of heat over land and sea on summer and winter monsoon circulations in humid tropical Asia, and the resultant effects on rainfall patterns • Atmospheric and surface conditions necessary for the development of tropical cyclones and resultant effects on rainfall patterns • The three phases of the El Niño Southern Oscillation (ENSO) and the associated changes in rainfall over tropical Pacific: – El Niño phase – neutral phase – La Niña phase

Key Question	Content
	Students will understand that:
2. Drainage Basin Hydrology	
How does the balance between input and output in the drainage basin system vary in the tropics?	• Input of water into the drainage basin system via: – precipitation – snowmelt • Output of water from the drainage basin system via: – evapotranspiration – river discharge • Variations in the balance between input and output over time and space in the tropics due to natural factors
How does water storage in the drainage basin system vary in the tropics?	• Storage of water in the drainage basin system as: – channel storage – groundwater storage – interception storage – soil moisture storage • Variations in storage in the drainage basin systems in the tropics over time and space due to: – natural factors – human factors
How do pathways in the drainage basin system vary in the tropics?	• Movement of water through the drainage basin system via pathways: – baseflow – channel flow – infiltration – overland flow – percolation – throughflow • Variations in pathways in the drainage basin systems in the tropics over time and space due to: – natural factors – human factors
3. Floods in the Humid Tropics	
What factors contribute to fluvial flooding in the humid tropics?	• Occurrence of fluvial floods when peak discharge exceeds bankfull discharge and inundates adjacent areas that are usually dry • Factors contributing to occurrence of fluvial floods in the humid tropics: – natural factors – human factors
Why do fluvial floods affect places and people differently?	• Impacts of fluvial floods on places: – positive impacts – negative impacts • Variations in the effects of fluvial floods on places • Variations in the effects of fluvial floods experienced by different groups of people due to differences in their vulnerability
Can fluvial floods be effectively managed?	• Strengths and limitations of strategies to manage fluvial floods • Varying success of strategies to manage fluvial floods • Extent to which humans can control the occurrence of fluvial floods

Topic 2.2 Landforms in the Tropics

How do natural processes and human activities influence landforms in the tropics?

Present-day landforms are shaped by processes that have operated over very long timescales. These processes work together to shape the earth's surface, creating landforms that contribute to the splendour of the natural environment. As humans continue to build settlements in the natural environment, these landforms will be impacted by anthropogenic activities.
In this topic, students will examine landforms on the earth's surface, with a focus on river and karst landforms in the humid tropics. Students will first study the various geomorphic processes that shape the earth's surface. Their understanding of the geomorphic processes will enable students to explore the development of karst landforms and selected fluvial landforms in the humid tropics. Students will also examine how anthropogenic activities can impact karst and fluvial landforms in the humid tropics

Key Question	**Content**
	Students will understand:
1. Geomorphic Processes	
What influences the weathering of rocks?	• Weathering processes: – chemical weathering: carbonation, hydrolysis, oxidation, reduction, solution – physical weathering: freeze-thaw, pressure release, salt weathering, thermal weathering • Factors influencing weathering of rocks: – natural factors – human factors
What influences the movement of materials on slopes?	• Movement of materials on slopes: – mass movement: fall, flow, creep, slide – water erosion: rainwash, rillwash and splash erosion • Factors influencing movement of materials on slopes: – natural factors – human factors
What influences fluvial processes?	• Fluvial processes: – erosion: corrasion, corrosion, cavitation – transportation: traction, saltation, suspension, solution – deposition • Factors influencing fluvial processes: – natural factors – human factors
2. Karst Landforms in the Humid Tropics	
What karst landforms can be found in the humid tropics?	• Karst landforms: cockpit karsts, tower karsts, caves • Features of cockpit karsts: cone-shaped hills, star-shaped depressions • Features of tower karsts: towers, plains • Features of caves: solutional opening, speleothem
What factors influence the formation of karst landforms in the humid tropics?	• Role of geomorphic processes in the formation of karst landforms • Factors influencing the formation of karst landforms
What is the importance of karst landforms in the humid tropics?	• Ecosystem services provided by karst landforms • Impact of human activities on ecosystem services provided by karst landforms

Key Question	Content
	Students will understand:
3. Fluvial Landforms in the Humid Tropics	
What fluvial landforms can be found in the humid tropics?	• Fluvial landforms: meanders, braided channels and deltas • Features of meanders: sinuous channel, river cliff, point bar • Features of braided channels: mid-channel bars • Features of deltas: delta plain, delta front, prodelta
What factors influence the formation of fluvial landforms in the humid tropics?	• Role of geomorphic processes in the formation of fluvial landforms including the role of sediment removal and dispersal by waves and tides in the formation of deltas • Factors influencing the formation of fluvial landforms
What is the importance of deltas in the humid tropics?	• Ecosystem services provided by deltas • Impact of human activities on ecosystem services provided by deltas

CLUSTER 3: SUSTAINABLE FUTURE AND CLIMATE CHANGE

Topic 3.1 Cities in a Sustainable Future

Can cities be liveable yet sustainable?

More than half the world's population live in urban areas today. The proportion of people living in urban areas is expected to grow especially in less developed regions, putting pressure on natural environments. This is because cities consume more resources and produce more waste than rural areas. Therefore, managing the growth of cities effectively is key to achieve sustainable development.

In this topic, students will explore the challenges and opportunities to make cities sustainable. Students will first be introduced to how sustainable urban development can be measured. They will then study the management of waste, slums and urban reimaging. Students will also explore the complementarity and tension between sustainability and liveability. This understanding will be useful as they examine how two key identity markers – age and gender – can influence people's experience of living in urban areas.

Key Question	**Content**
	Students will understand:
1. Sustainable Urban Development	
How can sustainable urban development be measured?	• Dimensions of sustainable development in urban areas: – economic vitality – environmental integrity – social well-being • The use of relevant indicators to monitor sustainable urban development • Difficulties faced when measuring sustainable urban development: – difficulty in deciding what aspects of the dimensions to measure – difficulty in selecting appropriate indicators
How do urban population trends influence progress towards sustainable development?	• Possible challenges in progressing towards sustainable urban development: – high urbanisation rates and rapid urban growth – urban population loss
How does the demand placed on natural environments by urban areas influence progress towards sustainable development?	• Demand placed on natural environments due to: – high concentration of waste – large ecological footprints – vast quantities of resources absorbed by urban areas from the surrounding areas • Demand placed on natural environments when waste is not viewed as a potential resource • Demand placed on the environment of the surrounding areas resulting in environmental problems there

Key Question	Content
	Students will understand:
2. Sustainable Cities	
Why is effective waste management important for progress towards sustainable urban development?	• Problems associated with non-hazardous solid waste in urban areas of countries at different levels of development • Impact of these problems on sustainable urban development • Varying success of strategies to manage non-hazardous solid waste across places
Why is effective slum management important for progress towards sustainable urban development?	• Reasons for development of slums in urban areas of countries at different levels of development • Impact of multiple deprivations experienced by slum dwellers on sustainable urban development • Varying success of strategies to improve the lives of slum dwellers across places
Why is effective urban reimaging important for progress towards sustainable urban development?	• Economic reasons for urban reimaging efforts • Impact of urban reimaging on sustainable urban development • Varying success of urban reimaging strategies across places
3. Liveable Cities	
How are sustainable urban development and liveability related?	• Subjective nature of liveability due to place, time and purpose of the assessment • Factors influencing liveability of a place: – economic factors – environmental factors – social factors • Complementarity and tension between sustainable urban development and liveability
How do we create liveable cities for the elderly?	• Increase in proportion of the elderly in urban areas in countries at different levels of development • Issues faced by the elderly living in the city related to: – economic well-being – social well-being – psychological well-being • Varying success of strategies to address the issues faced by the elderly living in the city
How do we create liveable cities for women?	• Importance of gender equality for progress towards liveable cities • Issues faced by women living in the city related to their: – economic well-being – social well-being – psychological well-being • Varying success of strategies to address the issues faced by women living in the city

Topic 3.2 The Future with Climate Change

Can we successfully respond to climate change?

Scientists know that global warming is occurring from evidence such as measurements of rising surface air temperatures and observations of retreating glaciers. They believe that global warming is largely caused by human activities, resulting in climate change. The Intergovernmental Panel on Climate Change (IPCC) warns that climate change can compromise our progress towards sustainable development. Climate change also impacts different aspects of our lives, including economic, environmental and social dimensions.

In this topic, students will learn about contemporary climate change. Students will first study contemporary climate change in relation to past changes in Earth's climate. This will provide students with a better understanding of anthropogenic contributions to contemporary climate change. Students will then examine how contemporary climate change might impact humans, deepening their understanding of human-environment interactions. Students will also explore possible responses to climate change, and the challenges associated with the planning and implementation of these responses.

Key Question	**Content**
	Students will understand:
1. The Science of Climate Change	
Is climate variability a new phenomenon in Earth's history?	• Evidence of past climate variability derived from proxy indicators through the study of ice and ocean cores • Episodes of warming and cooling of Earth during the Quaternary period
Can natural factors fully account for contemporary climate change?	• Natural factors influencing temperature variability in the Quaternary period: – changes in solar output – changes in thermohaline circulation – changes in ice sheets • Influence of these natural factors on temperatures through feedback mechanisms
How significant is the influence of human activities on Earth's climate compared to natural factors?	• Consensus within the scientific community, represented by the Intergovernmental Panel for Climate Change (IPCC), that climate change in the last two centuries is unequivocal and it is very likely caused by human activities • Influence of human activities on the global carbon cycle: – activities that increase carbon emissions – activities that reduce carbon sinks • Enhanced greenhouse effect due to the increased concentration of greenhouse gases by human activities • Role of human activities in: – accelerating warming through positive feedbacks – suppressing warming through negative feedbacks

Key Question	Content
	Students will understand:
2. Possible Effects of Climate Change	
How will contemporary climate change impact humans?	• Changes in temperature and precipitation associated with contemporary climate change • Impacts of contemporary climate change on aquatic and terrestrial ecosystems • Impacts of these changes in aquatic and terrestrial ecosystems on humans
Will contemporary climate change impact everyone in the same way?	• Impacts of contemporary climate change on places: – positive impacts – negative impacts • Variations in negative impacts of contemporary climate change due to: – uneven changes in temperature and precipitation across places – differences in vulnerability of different groups of people
How certain are we of the present and future impacts of contemporary climate change?	• Reasons for uncertainty over present and future impacts of contemporary climate change: – lack of full understanding of physical processes – incomplete in-situ data on vast expanses of oceans, deserts and polar regions – intrinsic measurement errors in current climate data – uncertainty over future greenhouse gas emissions
3. Responses to Climate Change	
How can we respond to contemporary climate change?	• Mitigation strategies to reduce greenhouse gas emissions and enhance carbon sinks • Adaptation strategies to help human populations adjust and cope with actual or expected climate change and its effects
Who are the key actors involved in climate change response?	• Role of key actors in climate change response: – firms – non-governmental organisations (NGOs) – state • Importance of partnerships between firms, NGOs and states in responding to climate change
Are all places able to implement effective strategies to respond to contemporary climate change?	• Varying success of strategies to respond to climate change • Challenges in implementing strategies to respond to climate change: – economic challenges – political challenges – uncertainties over future impacts of climate change

Additional Notes on Content
Students are required to be familiar with the following terms which are essential to build an understanding of the content covered in Clusters 1–3.

Macro-regions (as classified by World Bank) East Asia and Pacific; Europe and Central Asia; Latin America and the Caribbean; Middle East and North Africa; North America; South Asia; and Sub-Saharan Africa

Economic sectors Agricultural sector, manufacturing sector and service sector

Structure of TNCs Headquarters, research and development centres, branch offices, branch plants

Climographs Mean annual temperature, annual temperature range, annual total rainfall and rainfall distribution

Drainage basin system Potential evapotranspiration, actual evapotranspiration, upstream, downstream, river source, river mouth

Hydrographs Peak rainfall, peak discharge, lag time, rising limb and recession limb

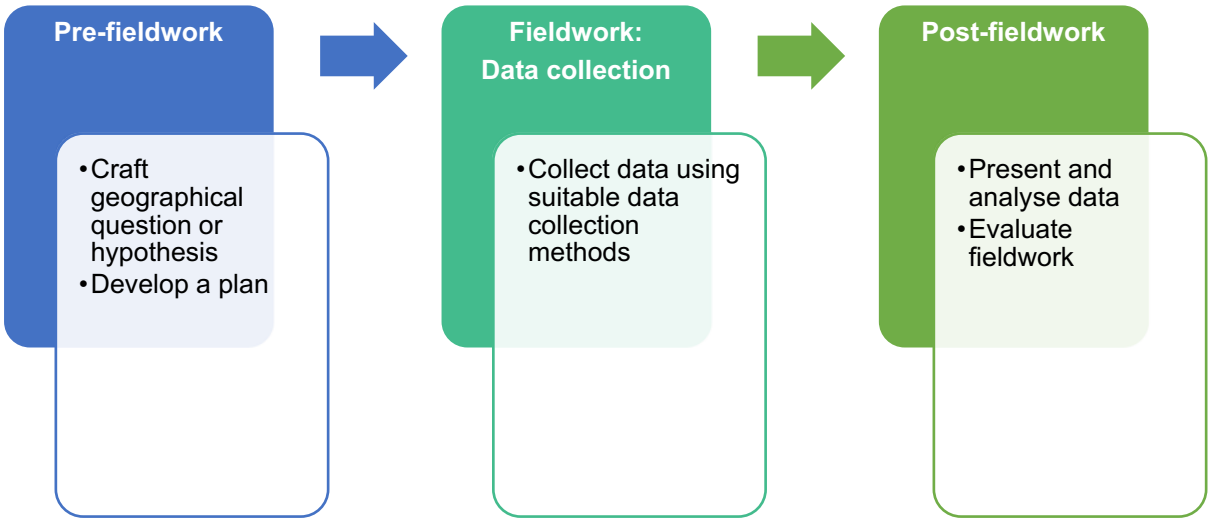
Urban areas Central city, suburbs and rural-urban fringe

CLUSTER 4: FIELDWORK

With guidance from the teacher, students will identify a suitable geographical question or hypothesis to conduct fieldwork. This can be completed individually or in small groups. Students should devise geographical questions or hypotheses and follow through the fieldwork in the following areas:

- Community response to climate change
- Needs analysis of the elderly living in an urban neighbourhood
- Fluvial flood risk and strategies to mitigate it

The fieldwork should reflect the following stages:



1. Pre-fieldwork stage

Craft Geographical Question or Hypothesis
Students should be able to craft geographical questions/hypotheses based on geographical issues or phenomenon that are:

- at a suitable scale
- researchable or measurable
- clearly defined.

Develop a plan
Students should be able to develop a plan that:

- establishes the primary and secondary data needed to examine the question/hypothesis posed
- identifies appropriate methods to determine sample size, select sample and collect data
- ensures accuracy and reliability of data collected
- addresses possible issues related to research ethics and the limitations imposed by resources
- minimises potential risks in undertaking fieldwork.

2. Fieldwork stage: Data collection

Collect data using suitable data collection methods
Students should be able to:

- collect primary data using appropriate methods
- collect secondary data including available data from geospatial technologies.

3. Post-fieldwork stage

Present and analyse data
Students should be able to:

- organise and represent data using appropriate methods (see Additional Notes on Data)
- analyse the data using appropriate qualitative and quantitative methods
- draw conclusions in relation to the question/hypothesis posed.

Evaluate fieldwork
Students should be able to:

- Evaluate the validity of the fieldwork in terms of data collected and methods used to collect and present data.

Additional Notes on Data
Students are required to be familiar with the following types of data. Making sense of data and representing ideas using different graphical/tabular methods should be an integral part of learning Geography, including fieldwork.

Maps contour maps, choropleth maps, isoline maps, dot maps, flow-line maps, proportional symbols maps and cartograms

Graphs pie charts, bars, histograms, scatter graphs, radar charts, triangular graphs and line graphs

Photographs landscape photographs, aerial photographs and satellite images

Others tables, schematic diagrams, illustrations and cartoons

Glossary of Relevant Content Concepts

Accuracy	Accuracy refers to the degree to which the result(s) of a measurement is close to the accepted true value. A more accurate measurement is one that is closer to the true value. Accuracy may be enhanced by increasing the precision of the measurement though a precise measurement may not always be accurate.
Adaptation	Adaptation refers to techniques that are focused on limiting the vulnerability to the impacts of an event. The adaptation to climate change refers to the process of adjustment to actual or expected climate and its effects, to moderate harm or exploit beneficial opportunities.
Agricultural sector	The agricultural sector involves the extraction of materials from the natural environment and may include activities such as hunting, forestry and fishing.
Braided channels	A braided channel is a river channel consisting of separate, but interlinked, migrating channels flowing either side of active unvegetated bars that change position owing to bed load transport.
Deltas	Deltas are partly subaerial and partly subaqueous accumulations of riverborne sediment deposited at the mouth of the river, with the sediment reorganised by tides, waves and currents. Deltas have three components: a low and flat delta plain forming the subaerial part of the delta; the seaward-dipping part which extends offshore beyond the delta plain, called the delta front; and the subaqueous low edge of the delta in front of and below the delta front, termed the prodelta.
Deprivation	Deprivation is the lack or absence of a resource or opportunity regarded as necessary for a basic standard of living.
Development	The term ‘development’ is used in different ways in development studies literature – as a fundamental or structural change; as intervention and action aimed at improvement, regardless of whether betterment is actually achieved; as improvement, with good as the outcome; and as the platform for improvement, encompassing changes that will facilitate development in the future. In the arena of socio-economic change, it implies efforts to improve the lives of people around the world.
Drainage basin	A drainage basin is the area of land surface from which water and sediment are transferred by individual channels that join up to form a network. The drainage basin is a convenient unit for analysis as it is normally well defined topographically; it can be studied as a series of nested units of increasing size and it is a system for which inputs and outputs of mass and energy can be defined and measured. Change that occurs in any portion of a drainage basin can affect the entire system.
Capital	Capital refers to money invested with the intent of generating more money.
Caves	Caves are underground openings through which water in the subsurface circulates. Caves may occur as isolated openings in rock but they usually have input and output points connected by conduits, at least 5–15 mm in diameter. Caves occur at different depths through the bedrock.
Community response	Community response refers to any action carried out by non-governmental and non-corporate stakeholders.
Cockpit karst	Cockpit karsts are star-shaped depressions surrounded by cone-shaped hills.

Contemporary climate change	Contemporary climate change is the changes in the state of the climate that persists for an extended period, typically decades or longer in more recent times. The IPCC uses the pre-industrial period – the period prior to the onset of large-scale industrial activity around 1750 – as a reference. The reference period 1850–1900 is used to approximate pre-industrial global mean surface temperature.
Climate variability	Climate variability refers to variations in the mean state and other statistics such as standard deviations and the occurrence of extremes of the climate on all spatial and temporal scales beyond that of individual weather events. Climate variability may be due to natural internal processes within the climate system or to variations in natural or anthropogenic external forcing.
Climate zones	A climate zone is an area designated by broadly similar weather statistics, especially temperature and precipitation.
Ecological footprint	Ecological footprint expresses the impact of human activity on ecosystems in terms of the area of productive land and aquatic ecosystems required to produce the resources used and to assimilate the wastes produced by a defined population at a specified material standard of living, wherever on Earth that land may be located.
Ecosystem	An ecosystem is a dynamic complex of plant, animal and microorganism communities and the non-living environment interacting as a functional unit. Humans are an integral part of ecosystems. The concept of an ecosystem provides a valuable framework for analysing the linkages between people and the environment. Ecosystems vary greatly in size.
Ecosystem services	Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other non-material benefits.
Enhanced greenhouse effect	The enhanced greenhouse effect takes place due to the increased concentration of greenhouse gases in the atmosphere. More long-wave radiation is intercepted and absorbed by the greenhouse gases, resulting in higher global temperatures.
El Niño Southern Oscillation (ENSO)	ENSO involves the shifting of sea-surface temperatures, air pressure and winds across the tropical Pacific. El Niño is ENSO's warm phase and La Niña is its cool phase.
Energy security	Energy security is the reliable supply of energy at reasonable prices.
Extractive industries	Extractive industries represent the initial stage in the basic production circuit and global production networks. The extractive industries fall into three broad categories based upon the kind of minerals involved – energy minerals, metallic minerals and non-metallic minerals.
Feedback mechanism	Feedback mechanisms in the climate system occur when a perturbation in one climate quantity causes a change in a second quantity and the change in the second ultimately leads to an additional change in the first. A negative feedback is one in which the initial perturbation is weakened by the changes it causes. A positive feedback is one in which the initial perturbation is enhanced.
Flood risk	Flood risk refers to the actual exposure of something of human value to a flood. It can be measured as the product of the probability of a flood occurring and the loss created by the flood.

Fluvial floods	A fluvial flood is a high water flow that passes over the natural bank along any portion of a stream, resulting in land not normally covered by water to be inundated.
Fluvial processes	Fluvial processes are stream- or river-related processes. In fluvial systems, water dislodges, dissolves or removes surface material through the process of erosion. This material is them transported to new locations, where it is laid down in the process of deposition.
Gender equality	Gender equality refers to the equality between women and men. It refers to the equal rights, responsibilities and opportunities of women and men and girls and boys. Equality between women and men is seen both as a human rights issue and as a precondition for, and indicator of, sustainable development.
Geomorphic processes	Geomorphic processes are the various chemical and physical means by which the earth's surface undergoes modification. They include processes of transformation and transfer associated with weathering, gravity, water, wind and ice.
Global atmospheric circulation	Global atmospheric circulation covers large portions of the earth and are maintained over an extensive period of time.
Global carbon cycle	The global carbon cycle is the flow of carbon in various forms, e.g. through the earth's atmosphere, hydrosphere, terrestrial and marine biosphere and lithosphere.
Global economy	The global economy refers to the qualitative transformation of economic relationships across geographical space characterised by interconnectedness and integration. The economy is a set of human activities and institutions linked together in the production, distribution, exchange and consumption of goods and services.
Global production networks (GPNs)	GPNs refer to the extensive webs of intra-, inter- and extra-firm connections through which commodities are produced, distributed, sold and consumed. These networks are geographically extensive and functionally integrated across national boundaries.
Input	An input is a source of water to a drainage basin.
Labour	Labour generally refers to the people who work for gain, often in terms of wages. Labour is often regarded as a location-specific factor of production that affects where a firm may choose to locate its relevant operations.
Manufacturing sector	The manufacturing sector involves the transformation of primary sector outputs into useable goods.
Mass movements	A mass movement is the downslope movement of sediment, soil and rock material as single unit. Mass movements take place when the driving force of gravity, which creates shear stress, exceeds the resisting force created by the shear strength of the slope materials.
Meanders	A meander is a sinuous river channel that migrate downstream owing to riverbank erosion on the outside of meander bends and deposition of bed material on the inner bank.
Mitigation	Mitigation is intervention to reduce or alleviate the severity of magnitude of impact of an event. The mitigation of climate change refers to human intervention to reduce emissions or enhance the sinks of greenhouse gases.

Multilateral institutions	Multilateral institutions are international institutions created by states, usually as a means of achieving collective objectives that could not be accomplished by acting individually.
Non-governmental organisations (NGOs)	NGOs are organisations formed by members of the public and have no government connections.
Non-hazardous solid waste	Non-hazardous solid waste includes waste from households, businesses and institutions such as schools and government buildings. Non-hazardous solid waste does not include substances that are toxic to humans, plants or animals, are flammable, corrosive or explosive or have high chemical reactivity.
Non-renewable resources	Non-renewable resources are resources that have taken millions of years to form and so their availability is finite. There is no possibility of them being replenished on a timescale of relevance to human society.
Output	An output represents the loss of water from the drainage basin.
Pathways	Pathways are the routes that water takes through the drainage basin from inputs to outputs.
Proxy indicators	Proxy indicators are indirect evidence. In the study of past climates, the information obtained from geological and biological records are proxy indicators – evidence derived from sources other than human measurements.
Quaternary period	The Quaternary period extends from 2.6 million years ago till present. There are two epochs within the Quaternary period – the Pleistocene and the Holocene. The Pleistocene is the period of Earth's history covering approximately 2.6 million years ago until 11 700 years ago. The second epoch of the Quaternary, the Holocene, is the last 11 7000 years of earth's history.
Resource availability	Resource availability refers to the part of the resource base available for human exploitation.
Regenerative capacity	Regenerative capacity is the capacity of a renewable resource to replace itself. A resource's regenerative capacity can be damaged by human activities. If a renewable resource is used or extracted faster than it can be replenished, its supply can decline over time.
Reliability	Reliability refers to the consistency of the measurement, and the degree to which the measurement may vary from reality due to measurement error. This involves establishing whether the measurement instrument, device, or method measures the attribute/variable the same way for each observation, or the same way each time or place it is used. Reliability is considered a necessary but insufficient prerequisite for a valid measurement.
Renewable energy sources	Renewable energy sources are naturally replenished and cannot be used up. Renewable energy sources include those that utilise renewable resources that can be depleted, sustained or increased by human activity; and those that utilise resources that are available irrespective of human activity.
Renewable resources	Renewable resources are resources that are naturally renewed within a sufficiently short timespan to be of use to human society.
Service sector	The service sector involves work done as an occupation or business for other individuals or businesses that brings about a change in the condition of a person or of a good belonging to some economic unit which does not produce or modify physical goods.

Slum	A slum household is defined as one where the members experience one or more of the following: lack of access to improved water source, lack of access to improved sanitation facilities, lack of sufficient living area, lack of housing durability and lack of security of tenure.
States	States are political units having recognisable control over a given territory.
(Water) Storage	Storage are locations where water is stored for a period of time. Water can be stored in surface and sub-surface storage.
Sustainable development	Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development requires meeting the essential needs of all, in particular the essential needs of the poor, and extending to all the opportunity to fulfil their aspirations for a better life. The concept of sustainable development implies limits including limitations imposed by the present state of technology on environmental resources and by the ability of the biosphere to absorb the effects of human activities.
Sustainable urban development	Sustainable urban development is the achievement of the objectives of sustainable development at the urban scale.
Synoptic scale circulation	Synoptic scale circulations have areas on the order of hundreds or thousands of square kilometres. High-pressure and low-pressure patterns over large parts of continents occur at the synoptic scale.
Thermohaline circulation	Thermohaline circulation refers to the large-scale circulation of the world's oceans, involving the vertical movement of large bodies of water, driven by variations in temperature and salt content. Cold, salty water sinks in 'downwelling zones', particularly at high latitude in the North Atlantic, and flows slowly southward along the bottom of the Atlantic and into the Pacific, where it rises again mainly in an 'upwelling' zone of western South and Central America. It then flows back as a surface current. The thermohaline circulation is important in transporting heat through the Earth system.
Tower karst	Tower karsts are a steeper variety of karst risers than cone karsts. In general, towers are steeper and higher than cones and have a bigger height-diameter ratio. These residual hills come in a range of shapes, though a common dominant feature is their sharp rise from the surrounding plains.
Trade	Trade generally refers to the buying and selling of goods and services. International trade refers to the buying and selling of goods and services between countries.
Trade-offs	Trade-offs involve making difficult choices at particular points in time and at particular scales as to what is being pursued and how; that certain goals can be compromised to achieve others; and that any action will carry unequal impacts for particular interests and for groups of people.
Transboundary water resources	Transboundary water resources are shared by two or more countries.
Transnational corporations (TNCs)	TNCs are major business organisations that have the power to coordinate and control operations in more than one country.
Tropical cyclones	A tropical cyclone is a very large low-pressure system that occurs in the tropics and subtropics and has a revolving wind velocity of at least 119 kph. Tropical cyclones are known under different names in different regions: hurricanes in the tropical Atlantic, Caribbean, and Northeast and Southeast Pacific; typhoons in the Northwest Pacific; and tropical cyclones in the Indian Ocean and Australian seas.

Tropics	The tropics is an area of radiative surplus at the earth-atmosphere interface. It is a low-latitude climatic region, characterised by high temperature. The margin of the tropics is a fluctuating boundary, between 30 and 35 degrees of latitude. The tropics can be divided into two primary units based on annual rainfall: the humid tropics and the arid tropics.
Urban areas	Urban areas may be identified based on population size, economic base, administrative criteria or functional definitions. Urban areas are diverse in characteristics.
Urban growth	Urban growth is an increase in the population of urban areas. Urban growth has three components – natural increase, migration and reclassification.
Urban liveability	Urban liveability is a relative term whose precise meaning depends on the place, time, purpose of the assessment and on values of the assessor. This view contends that quality is not an attribute inherent in the environment but a behaviour-related function of the interaction between individuals and their environment.
Urban reimaging	Urban reimaging aims to control or influence how others see a place by enhancing and promoting positive images of an urban area. Urban reimaging may involve the physical reshaping of urban areas.
Urbanisation rate	Urbanisation rate is defined as the rate at which the percentage urban grows or declines. It is a function of the respective rates of change and relative sizes of the urban and rural populations in a country. It is expressed as a per cent. Urbanisation rates can be positive or negative.
Validity	Validity refers to the degree to which a measurement instrument, device, or method measures what the researcher intended to measure (such as a variable, concept, or construct). This involves establishing the extent to which the data and its interpretation support one's findings, and one's use of it.
Vulnerability	Vulnerability is a possible future state that implies high risk combined with an inability to cope.
Water erosion	Water erosion is the removal of grains of material on slopes by water. Splash erosion occurs when raindrops detach material through the impact of drops on the surface. Rillwash occurs when rainflow is occurring in small channels carved out of the slope. Rainwash is the erosion of soil by overland flow processes.
Weathering	Weathering is a process, at or near the interface between the crust and the atmosphere, which alters the physical and chemical nature of rocks in situ. The processes of weathering comprise a set of sub-processes that can be grouped broadly into two classes: physical and chemical weathering. Physical weathering includes the sub-processes that lead to the breaking up of rocks into smaller units without significant alterations. In chemical weathering, original minerals in the hard rock react with ambient atmospheric conditions and with any water flowing across the rock surface to change into new and softer minerals.

Appendix A

Levels	Marks	Generic Level Descriptors for H2 Fieldwork Evaluative Question
3	9–10	Evaluation is analytical and coherent. Response addresses the question and demonstrates good knowledge and understanding of fieldwork methods relevant to the given context.
2	5–8	Evaluation is mostly analytical and coherent. Weaker responses in this level will have evaluation that is broadly analytical and generally coherent. Response generally addresses the question and demonstrates adequate knowledge and understanding of fieldwork methods relevant to the given context.
1	1–4	Response is descriptive with limited or no analysis and evaluation. Response is fragmented and lacks clarity. Response lacks focus on the question and may be largely irrelevant to it. Response shows basic knowledge and understanding of fieldwork methods. Response has some, though limited, relevance to the given context.
0	0	No creditworthy response

Appendix B

Levels	Marks	Generic Level Descriptors for H2 Essays
5	18–20	Evaluation is consistently analytical and coherent. Response is well-supported by relevant material, including the effective use of examples. Response features accurate geographical knowledge and reflects good understanding of the subject content relevant to the question.
4	14–17	Evaluation is analytical and coherent. Response is mostly well-supported by relevant material, including the appropriate use of examples. Response features accurate geographical knowledge and reflects adequate understanding of the subject content relevant to the question.
3	10–13	Evaluation is broadly analytical and generally coherent. Response is moderately well-supported by relevant material, including some appropriate use of examples. Response features accurate geographical knowledge and reflects adequate understanding of the subject content relevant to the question.
2	6–9	Response is largely descriptive with limited analysis and evaluation. Response is partly coherent and may lack clarity in parts. Response is poorly supported by relevant materials, including the limited use of examples. Response features inaccurate geographical knowledge and poor understanding of the subject content relevant to the question.
1	1–5	Response is descriptive with no analysis or evaluation. Response is fragmented and lacks clarity. Response consists of unsupported assertions. Response features largely inaccurate geographical knowledge and a lack of understanding of the subject content relevant to the question.
0	0	No creditworthy response