



ANGLO-CHINESE JUNIOR COLLEGE

JC2 H1 Geography Preliminary Examinations (2019)

H1 GEOGRAPHY

8813/01

Paper 1

30 August 2019

3 hours

Additional Materials: Writing Paper
World outline map

READ THESE INSTRUCTIONS FIRST

Write your name and class in the spaces provided below, and on the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **four** questions in total.

Section A

Answer Question 1.

Section B

Answer Question 2.

Section C

Answer **two** questions, each from a different theme.

The Insert contains all the Resources referred to in the questions.
You should make reference to appropriate examples studied in the field or the classroom, even where such examples are not specifically requested by the question.
Diagrams and sketch maps should be drawn whenever they serve to illustrate an answer.
You are reminded of the need for good English and clear presentation in your answers.

The number of marks is given in brackets [] at the end of each question or part question.

At the end of the examination, your answers to each question should be securely fastened and separated into 4 bundles. The cover page must be attached as the top sheet to your answers to Section A.

This question paper consists of **4** printed pages of questions and **1** Insert.

[Turn over

Section A

Theme 3: Geographical Investigation

- 1 The Kallang area occupies an important position in Singapore's culture and history, particularly due to the several iconic sports locations sited within its boundaries. The area has also hosted numerous high-profile sporting events.

A group of 25 students from a Junior College wanted to examine the accessibility of the Kallang area for different groups of people living in the neighborhood. The students took one week during their December vacation to conduct the study via site observations and the use of a questionnaire survey on 100 respondents, administered at the entrance of the Stadium MRT station. They also have access to secondary data including photos and a land-use map.

Resource 1 shows the photos of the Kallang area before and after development. Resource 2 shows the current land-use map of the Kallang area, including several flagship landmarks.

Resource 3 shows a sample of the survey questions crafted by the students.

- (a) Suggest a suitable research question for the students' investigation and explain **two** reasons why the research question is at a suitable scale. [5]
- (b) Explain how Resources 1 and 2 could provide information to investigate the accessibility of the Kallang area. [4]
- (c) With reference to Resource 2, explain how this group of students could minimize potential risks in their investigation. [3]
- (d) The group concluded that the results of their questionnaire survey may not be reliable. Using Resources 2 and 3, suggest how this process of data collection could be improved. [6]
- (e) The Urban Redevelopment Authority (URA) has asked the group to gather information to assess the success of urban reimagining of Kallang area. Outline how the group would go about collecting the information. [7]

[Turn over

Section B**Theme 1: Climate Change and Flooding****Climatic and flooding in Hyderabad, India**

- 2 Hyderabad is a city in India. Resource 4 shows the climograph of Hyderabad. Resource 5 shows the topographical relief for India in July. Resource 6 shows the position of the Inter-Tropical Convergence Zone (ITCZ) in July and January. Resource 7 shows the path of Cyclone Hudhud in 2014.
- (a) Using Resource 4, describe the climatic characteristics of Hyderabad. [3]
- (b) Using Resources 5 and 6, account for the climatic characteristics of Hyderabad as shown in Resource 4. [5]
- (c) With the aid of Resource 4 and a labelled diagram, explain the storm hydrograph of a river downstream of Hyderabad in August. [5]
- (d) Using Resource 7, explain the formation of tropical cyclone. [4]
- (e) Using Resource 7 and your own knowledge, evaluate the extent to which tropical cyclones contribute to flooding in the tropics. [8]

[Turn over

Section C

Answer **two** questions from this section.

Answer **either** Question 3 **or** Question 4, and **either** Question 5 **or** Question 6.

Theme 1: Climate Change and Flooding

- 3 (a) Explain the causes of contemporary climate change in countries at low levels of development. [9]
- (b) Discuss the effectiveness of different strategies in managing climate change. [16]
- 4 (a) Explain the role of climate in affecting the flows and stores of the hydrological cycle in the humid and arid tropics. [9]
- (b) 'Hard-engineering strategies are the most effective in managing floods.'
How far do you agree with this statement? [16]

Theme 2: Urban Change

- 5 (a) Explain the reasons for the development of urban slums in countries at low levels of development. [9]
- (b) Discuss the challenges in managing non-hazardous solid waste in urban areas. [16]
- 6 (a) Explain how urban liveability can be measured in countries at high levels of development. [9]
- (b) To what extent does the social environment contribute to the extent of crowding in urban areas? [16]

[End

**ANGLO-CHINESE JUNIOR COLLEGE****JC2 H1 Geography Preliminary Examinations (2019)**

H1 GEOGRAPHY**8813/01**

Insert

30 August 2019**3 hours**

READ THESE INSTRUCTIONS FIRST

This Insert contains all the Resources referred to in the questions.

This Insert consists of 8 printed pages.

Resource 1 for Question 1
Photos of Kallang area before and after development

Before:



After:



Resource 2 for Question 1
Current land-use map of Kallang area



COMMUNITY FACILITIES

- 1 Beach Volleyball


- 2 Stadium Riverside Walk


- 3 Stadium Roar


- 4 Kids Water Playground


- 5 Skate Park


- 6 Hard Courts*


- 7 Arena Park


- 8 Kids' Playground


- 9 Fitness Corner


- 10 Giant Chess*


- 11 Lawn Bowls*



*Booking required. Visit <https://obs.sportshub.com.sg/view/2556/community-facilities> to book your slots.

Resource 3 for Question 1
Sample of the survey questions crafted by the students

Survey Form on Kallang

1. Age of interviewee *

2. Kallang caters well to different groups of people. *

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

3. Kallang meets my needs as a resident *

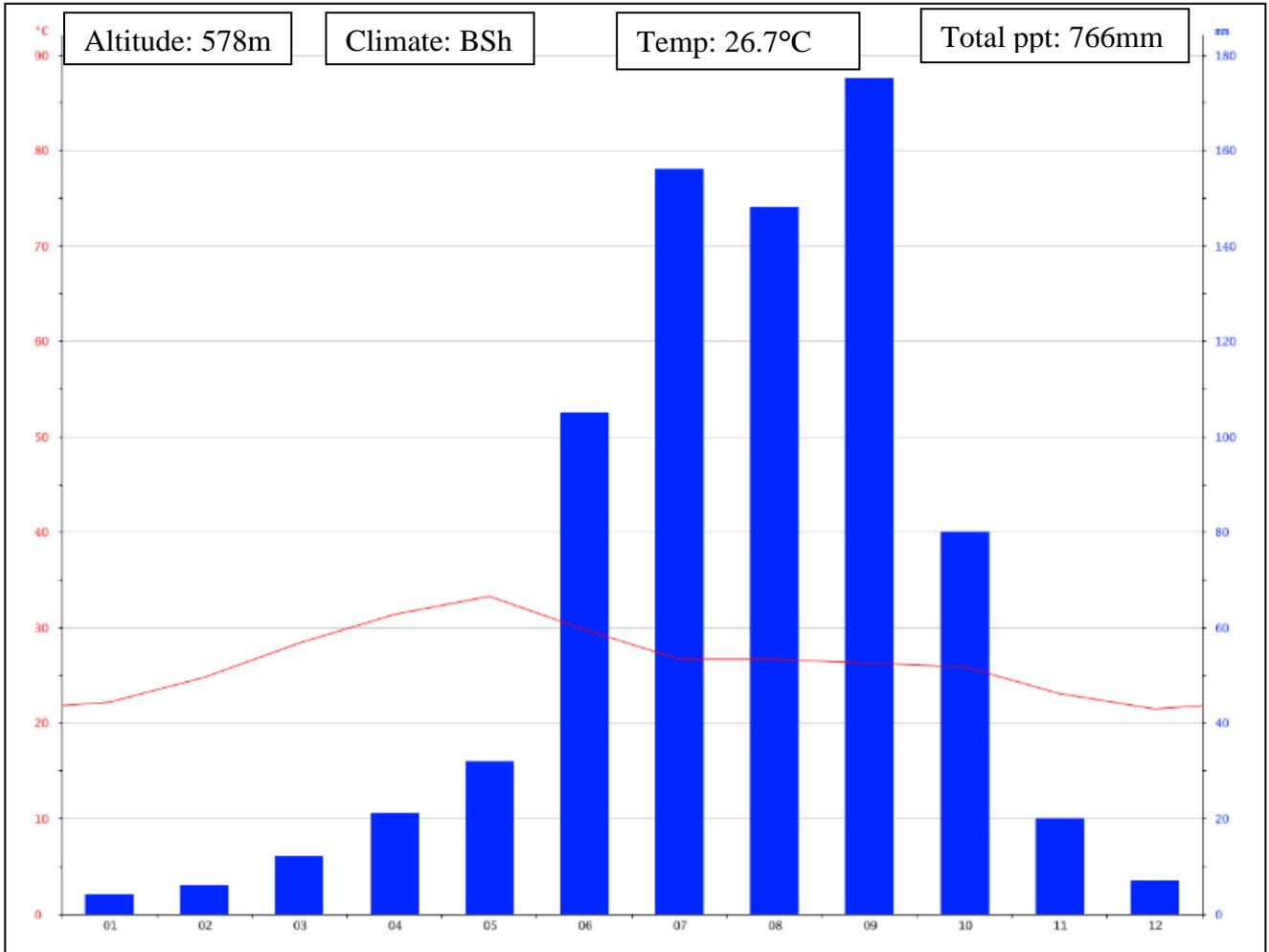
Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

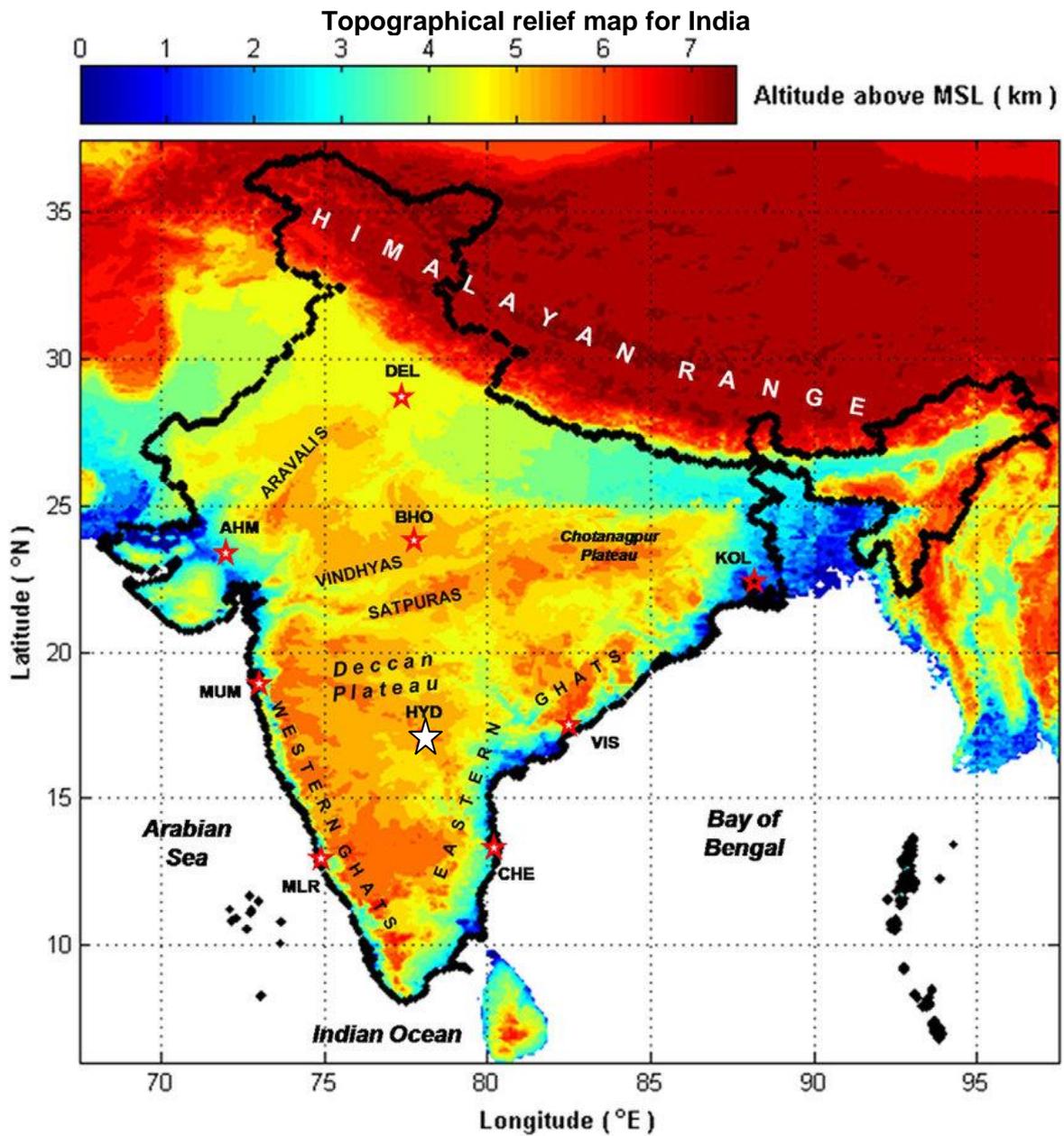
4. What are your main issues about living in Kallang? *

Resource 4 for Question 2

Climograph for Hyderabad, India



Resource 5 for Question 2



Legend:

☆ : Location of Hyderabad

Resource 6 for Question 2

Position of ITCZ in July and January



Legend:

☆ : Location of Hyderabad

Resource 7 for Question 2

Path taken by Cyclone Hudhud, 2014



Acknowledgement of Resources	
Resource 1:	https://roots.sg/Roots/learn/stories/kallang-a-trailblazer/story https://www.archdaily.com/523365/singapore-sportshub-dparchitects/53b4e06cc07a803772000092-singapore-sportshub-dparchitects-image
Resource 2:	https://www.sportshub.com.sg/map
Resource 3:	ACJC Geography department
Resource 4:	https://en.climate-data.org/asia/india/hyderabad/hyderabad-2801/
Resource 5:	https://www.researchgate.net/figure/Topographic-Map-of-India.jpg
Resource 6:	https://courseware.e-education.psu.edu/courses/earth105new/graphics/L05_ITCZ.png
Resource 7:	https://smedia2.intoday.in/indiatoday/images/stories/2014October/hudhud-map_650_101314115826.jpg



ANGLO-CHINESE JUNIOR COLLEGE

JC2 H1 Geography Preliminary Examinations (2019)

Mark Scheme / Suggested Answers

Question	Answer	Marks															
1(a)	<p>Suggest a suitable research question for the students' investigation and explain two reasons why the research question is at a suitable scale.</p> <p>Possible research question: How accessible is the Kallang area through public transport?</p> <p>Reasons why question is at a suitable scale</p> <ul style="list-style-type: none"> • Suitable Scale: Time is adequate to obtain 100 questionnaires from the residents • Capable of Research: Groups have access to various sources of secondary data • OR students are able to craft a likert scale (existing methodology) to measure variables of accessibility • Clearly defined: accessibility as a variable can be measured/quantified <table border="1"> <thead> <tr> <th>Level</th> <th>Marks</th> <th>Descriptors</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>4-5</td> <td> <input type="checkbox"/> Response demonstrates clear knowledge and understanding of the different factors <input type="checkbox"/> Uses relevant, detailed and accurate factual information from the resources to support the answer <input type="checkbox"/> Reflects strong critical thinking skills <input type="checkbox"/> Source(s) is well used to support the response. </td> </tr> <tr> <td>2</td> <td>3-4</td> <td> <input type="checkbox"/> Research question is suitable and emphasis on accessibility is seen. <input type="checkbox"/> Uses factual information and conceptual understanding that is generally relevant to the given context but lacks detail and may contain some inaccuracies. <input type="checkbox"/> Displays critical thinking skills, but limited in response where answers are descriptive in parts. </td> </tr> <tr> <td>1</td> <td>1-2</td> <td> <input type="checkbox"/> Response attempts to give a suitable research question but may not have a clear emphasis on accessibility. <input type="checkbox"/> Answer lacks explanation of the reasons on why it is of suitable scale. </td> </tr> <tr> <td>0</td> <td>0</td> <td> <input type="checkbox"/> No creditworthy response. </td> </tr> </tbody> </table>	Level	Marks	Descriptors	3	4-5	<input type="checkbox"/> Response demonstrates clear knowledge and understanding of the different factors <input type="checkbox"/> Uses relevant, detailed and accurate factual information from the resources to support the answer <input type="checkbox"/> Reflects strong critical thinking skills <input type="checkbox"/> Source(s) is well used to support the response.	2	3-4	<input type="checkbox"/> Research question is suitable and emphasis on accessibility is seen. <input type="checkbox"/> Uses factual information and conceptual understanding that is generally relevant to the given context but lacks detail and may contain some inaccuracies. <input type="checkbox"/> Displays critical thinking skills, but limited in response where answers are descriptive in parts.	1	1-2	<input type="checkbox"/> Response attempts to give a suitable research question but may not have a clear emphasis on accessibility. <input type="checkbox"/> Answer lacks explanation of the reasons on why it is of suitable scale.	0	0	<input type="checkbox"/> No creditworthy response.	[5]
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<p>1(b)</p>	<p>Explain how Resources 1 and 2 could provide information to investigate the accessibility of the Kallang area.</p> <p><u>Indicative content</u></p> <p>Resource 1:</p> <ul style="list-style-type: none"> • Shows the changes made in the area after development • These changes can also affect liveability through the creation of an MRT station, corridors and roads which will increase the accessibility of the area. <p>Resource 2:</p> <ul style="list-style-type: none"> • Shows a current land-use map of the Kallang area which displays the various roads that people can use to access the area • There is also the MRT indicated which is in close proximity to the various sporting facilities found in the area. • The whole area is also accessible through foot with walkways linking each of the different facilities. <p><i>Point marked. Maximum 3m awarded if no data cited from resource.</i></p>	<p>[4]</p>
<p>1(c)</p>	<p>With reference to Resource 2, explain how this group of students could minimize potential risks in their investigation.</p> <p><u>Indicative content</u></p> <p>Risk: General safety</p> <ul style="list-style-type: none"> o Do a recce trip to map out places of potential hazards and places that can give first aid while looking for wet weather alternative routes too. <p>Conditions</p> <ul style="list-style-type: none"> o Check weather forecast and to do data collection on another day if the event of bad weather and lightning alert o Ensure that there is first-aider and first aid kit for the groups o Wear proper footwear to protect from sharp objects o Wear hats or use umbrella when the weather is too hot and have proper hydration <p>Risk: Proximity to large water bodies</p> <ul style="list-style-type: none"> o Brief students regarding dangers of entering the water bodies found within the site. <p>Risk: Timing of primary data collection</p> <ul style="list-style-type: none"> o Ensure that the data collection is done in the morning when it could be too hot and possible problem of dehydration o Stop investigation before sunset as the late timing may lead to students reaching home very late, issues of safety <p>Award 3 marks for a strategy to minimize the risk identified.</p>	<p>[3]</p>

<p>1(d)</p>	<p>The group concluded that the results of their questionnaire survey may not be reliable. Using Resources 2 and 3, suggest how this process of data collection could be improved.</p> <p>Indicative Content:</p> <p>Questions asked: Questions asked may not be relevant to their research.</p> <p>Data collected: The data collected may not be sufficient to provide a good overview of how Accessible Kallang . Can expand investigation to areas within the Kallang area.</p> <p>Timing: The collection of data is only done during the December holidays which may affect the accuracy of the results. To conduce the fieldwork on another day at the same timing so that it is more Representative.</p> <table border="1" data-bbox="272 772 1370 1283"> <thead> <tr> <th>Level</th> <th>Marks</th> <th>Descriptors</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>5-6</td> <td> <input type="checkbox"/> Response demonstrates accurate knowledge of data collection methods, issues with both accuracy and/or reliability of these and relevant improvements. <input type="checkbox"/> Reflects a good understanding of the context of the investigation and of data collection techniques. </td> </tr> <tr> <td>2</td> <td>3-4</td> <td> <input type="checkbox"/> Response demonstrates good knowledge of data collection methods. <input type="checkbox"/> Provides an explanation of issues relating to reliability and/or accuracy with some reference to possible improvements. <input type="checkbox"/> Description may be limited in depth and detail. </td> </tr> <tr> <td>1</td> <td>1-2</td> <td> <input type="checkbox"/> Some reference is made to issues with accuracy and reliability but may recommend inappropriate or irrelevant improvements or provide incorrect explanation of methods. <input type="checkbox"/> Response may be of limited relevance to the given context. </td> </tr> <tr> <td>0</td> <td>0</td> <td> <input type="checkbox"/> No creditworthy response. </td> </tr> </tbody> </table>	Level	Marks	Descriptors	3	5-6	<input type="checkbox"/> Response demonstrates accurate knowledge of data collection methods, issues with both accuracy and/or reliability of these and relevant improvements. <input type="checkbox"/> Reflects a good understanding of the context of the investigation and of data collection techniques.	2	3-4	<input type="checkbox"/> Response demonstrates good knowledge of data collection methods. <input type="checkbox"/> Provides an explanation of issues relating to reliability and/or accuracy with some reference to possible improvements. <input type="checkbox"/> Description may be limited in depth and detail.	1	1-2	<input type="checkbox"/> Some reference is made to issues with accuracy and reliability but may recommend inappropriate or irrelevant improvements or provide incorrect explanation of methods. <input type="checkbox"/> Response may be of limited relevance to the given context.	0	0	<input type="checkbox"/> No creditworthy response.	<p>[6]</p>
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<p>1(e)</p>	<p>The Urban Redevelopment Authority (URA) has asked the group to gather information to assess the success of urban reimaging of Kallang area. Outline how the group would go about collecting the information.</p> <p><u>Indicative Content:</u></p> <p>Developing a plan:</p> <ol style="list-style-type: none"> 1. Data: establish the data needed to prove the hypothesis, e.g. primary & secondary data (quantitative & qualitative) of will have to be collected 2. Timing: Candidates to decide the length of time <p>Data Collection:</p> <ol style="list-style-type: none"> 1. Sampling method: systematic sampling with the selection of five sites around the various parts of the Kallang area. 2. Candidates can conduct bi-polar surveys or interviews to gather data of residents opinion regarding the Kallang area. 3. Candidates can consider the use of vehicle count and pedestrian count. Consider research ethics: e.g. to obtain permission to conduct the investigation in Kallang, consideration for the public especially near walkways and roads; minimize noise disturbance, avoid littering 	<p>[7]</p>															

Consider limitations: e.g. the sample size, the lack of time and data collected not be conclusive.

Present and analyse data collected: establish a data representation method e.g. bar graph to see the opinion of the public.

Level	Marks	Descriptors
3	6-7	Response demonstrates accurate knowledge of geographical investigation methods. Outlines a relevant and coherent plan with reference to data collection, methods, investigation limitations and risk mitigation strategies. Response is relevant to context of question throughout
2	4-6	Response demonstrates some knowledge of geographical investigation methods. Outlines a clear plan with some reference to data collection, methods, investigation limitations and risk mitigation strategies. Response is mostly relevant to context of question but may lack clarity and coherence.
1	1-3	Response demonstrates limited or no knowledge of geographical investigation methods. Outline of plan is limited and may not refer to one or more of the facets of an investigation in their outline plan. Much of the response may not be relevant to context of question.
0	0	No creditworthy response.

Question	Answer	Marks
<p>2(a)</p>	<p>Using Resource 4, describe the climatic characteristics of Hyderabad.</p> <p><u>Indicative content</u></p> <p>Temperature:</p> <ul style="list-style-type: none"> • High annual temperature of 26.7°C with small temperature range of 10°C from 23°C to 33°C. <p>Precipitation:</p> <ul style="list-style-type: none"> • Relatively low annual precipitation of 766mm. <p>Seasonality:</p> <ul style="list-style-type: none"> • Strong seasonal pattern with distinct wet and dry season • Wet season: From June to October, with total precipitation amounting to 400mm which is more than half of the year’s precipitation in 5 months • Dry season: From November to May, where average rainfall per month in the dry season is 10mm or less <p><i>Point marked. Maximum 2m awarded if no data cited from resource.</i></p> <p>Examiner comments:</p> <ul style="list-style-type: none"> • Candidates were generally able to do well for this question, citing data and supporting their answers. • There were only a few candidates who tended to over-generalise their answers, causing a loss in credit in their answers. 	<p>[3]</p>
<p>2(b)</p>	<p>Using Resources 5 and 6, account for the climatic characteristics of Hyderabad as shown in Resource 4.</p> <p>Candidates are expected to use Resource 5 discuss the continental location of Hyderabad, and to use the ITCZ in Resource 6 to account for the variation in temperature and rainfall of Hyderabad shown in Resource 4.</p> <p><u>Indicative content:</u></p> <ul style="list-style-type: none"> • ITCZ’s position is near Hyderabad in July as seen in Resource 6. • With ITCZ near Hyderabad, it indicates that there is high insolation resulting in high temperature of up to 33°C, accounting for high convectonal rainfall. • With ITCZ also near Hyderabad, there is a low pressure zone, causing winds to converge on the region. This results in moisture-laden onshore winds moving towards Hyderabad, resulting in high rainfall of up to 80mm experienced in the months around July. • When the ITCZ migrates to the southern hemisphere as seen in Resource 6, the northeast Trade winds from the high pressure belt blow southwards as in dry continental winds blowing across Hyderabad and going offshore, causing the dry 	<p>[5]</p>

season in the months between November and March as seen in Resource 4. This can also account for the drop in average temperature over the region as seen in Resource 4, with temperatures dropping to around 22°C.

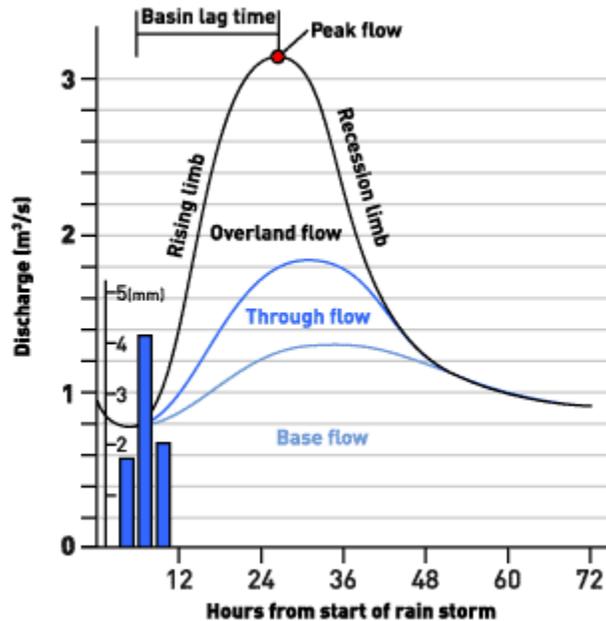
- Hyderabad’s location, being more inland as seen in Resource 5, results in it not experiencing high moisture levels experienced by coastal regions.
- The topography of the regions prevents it from experiencing high rainfall as it is in the rainshadow of the Ghats in India.

Level marked. Candidates are graded according to the level descriptors as shown below

Examiner comments:

- Generally, candidates tend to be generic in their explanation, and do not go into the details, which causes lapses in their explanation resulting in a loss of credit.
- Given the data provided, there were many candidates who did not refer to the data for information to support their answers and claims, which also resulted in a loss of credit.
- Stronger candidates tend to base their answers on the data provided, and make links to their explanation, which resulted in them getting more credit.

	Level	Marks	Descriptors	
	3	4-5	<input type="checkbox"/> Response demonstrates clear knowledge and understanding of the conditions relating to temperature and precipitation in Hyderabad, India. <input type="checkbox"/> Uses relevant, detailed and accurate factual information from the resources to support the answer (Resource 4 to cite temperature and precipitation, Resource 5 to cite inland location, Resource 6 to cite ITCZ position). <input type="checkbox"/> Reflects strong critical thinking skills, demonstrated through linking how altitude and ITCZ can affect temperature and precipitation <input type="checkbox"/> Source(s) is well used to support the response.	
	2	3-4	<input type="checkbox"/> A satisfactory response which is generally sound and contains relevant points relating to temperature and precipitation in Hyderabad, India, but may not always focus on Hyderabad and may tend to be more general <input type="checkbox"/> Uses factual information and conceptual understanding that is generally relevant to the given context but lacks detail and may contain some inaccuracies. <input type="checkbox"/> Displays critical thinking skills, but limited in response where answers are descriptive in parts. <input type="checkbox"/> Source(s) is used to support parts of the response.	
	1	1-2	<input type="checkbox"/> Response shows a poor understanding of climatic conditions in Hyderabad. <input type="checkbox"/> Uses basic factual information and conceptual understanding which has some, but limited, relevance to the question. <input type="checkbox"/> Answer lacks explanation, and tend to be more descriptive of the climatic conditions but without any explanation. <input type="checkbox"/> Source(s) is not used or not accurately used to support the response. <input type="checkbox"/> Provides little or no evaluation.	
	0	0	<input type="checkbox"/> No creditworthy response.	
2(c)	With the aid of Resource 4 and a labelled diagram, explain the storm hydrograph of a river downstream of Hyderabad in August. Candidates are required to draw a storm hydrograph of Hyderabad, based on the information provided by the resource. <u>Sample labelled hydrograph diagram:</u>			[5]



Marker to note: Parts circled in red are components that need to be labelled. Units to be included, with the main components as listed below included:

- Precipitation bar graph
- Rising Limb
- Recession Limb
- Lag Time

Explanation of hydrograph:

High peak rainfall: Due to the high rainfall experienced in August of 145mm, there will be high peak rainfall experienced during storm events.

Short lag time: Due to high rainfall experienced, coupled with Hyderabad bring an arid climate, there will be a short lag time due to rapid runoff and low infiltration of water into the sub-surface.

Flashy hydrograph: Due to lack of infiltration, the rising limb of the hydrograph will be steep, as overland flow (likely the Hortonian type) is quickly channelled to the mouth of the river.

Point marked. Award 2m for correctly labelled hydrograph, 1m each for explanation of Hydrograph. Maximum 4m awarded if no data from Resource 4 used to substantiate answer.

Examiner comments:

- With this question being on the hydrograph, there were only a few candidates who managed to score well due to the lack of adequate accurate labels on the hydrograph sketch.
- Most candidates attempted to explain the hydrograph and reasons for the various parts, but were unable to provide adequate complete explanations that

	<p>resulted in a loss of credit.</p> <ul style="list-style-type: none"> • There were some candidates that, perhaps due to being unsure of their concepts, attempted to write down everything they know about hydrology in their answers. To remind candidates that such practices are frowned upon, and for candidates to think through their answers before committing to it. 	
2(d)	<p>Using Resource 7, explain the formation of tropical cyclone.</p> <p>Candidates are to explain the process of cyclone formation with the aid of Resource 7.</p> <p><u>Indicative content:</u></p> <ul style="list-style-type: none"> • Cyclones are initially formed far from land, over large water bodies where there is sufficient depth of water for latent heat to be released for energy to drive the formation and increase in strength of the cyclone. This is seen in Resource 7 by the cyclone initially forming at the South-East area off the coast of India. • Cyclones will initially gain heat and start to gather air mass around it. This results in it gaining wind speeds, and move towards mainland India as air moves from high pressure to low pressure. This can be seen in Resource 7 as the windspeed of the cyclone increases as it moves inland, up to 64 knots. • In addition, the cyclone must be formed away from the equator for the Coriolis effect to take effect. This causes the cyclone to deflect to the right as it moves into the northern hemisphere. This can be seen in Resource 7 as the cyclone deflects to the right as it moves from its origin to continental India. • Eventually, as the cyclone makes landfall, it will lose its speed due to the absence of warm water bodies, resulting in a drop in wind speed as seen in Resource 7. <p><i>Point marked. Award 1m for each observation, 1m for data that supports the observation.</i></p> <p><i>Maximum 4m awarded if no data cited from the resource.</i></p> <p>Examiner comments:</p> <ul style="list-style-type: none"> • Generally, this question was well done by most candidates, with almost all candidates who attempted it getting a minimum of 3 marks. • Candidates have to take note to use the information from the data to support their answers, which is something that resulted in them losing credit in their answers when they do not actively refer to data provided. 	[4]
2(e)	<p>Using Resource 7 and your own knowledge, evaluate the extent to which tropical cyclones contribute to flooding in the tropics.</p> <p>Candidates have to first discuss the impact of tropical cyclones on communities, and how the occurrence of cyclones can contribute and cause flooding to happen in the tropics. Stronger candidates are able to provide case studies to substantiate their answers, and to provide other factors that may also cause flooding to corroborate their stand on how cyclones do or do not cause flooding.</p>	[8]

Indicative content: Causes of flooding

Note that points listed are not exhaustive, and are only selected points that candidates may have chosen to expound upon.

Cyclones:

- The onset of cyclones, due to its onshore nature of the wind, carries with it a huge amount of moisture.
- When making landfall, the moisture condenses into water droplets, and eventually falls to the ground as precipitation.
- The huge amount of precipitation falling on the area may result in overland flow to form as a result of subsurface stores becoming saturated, preventing any more water from infiltrating into the subsurface.
- From Resource 7, it is apparent that when cyclones make landfall, they bring with them heavy moisture and precipitation as seen when Hudhud made its landfall onto India, after picking up moisture across the Bay of Bengal.
- Some examples of cyclones that cause flooding at Cyclone Hudhud in 2014, which resulted in coastal India being flooded, and Cyclone Nargis in 2008, which afflicted many areas in Myanmar causing widespread flooding

Subsidence of land

- In many areas in the world, local communities rely on groundwater for their source of drinking water for their daily use.
- As communities increase in population, the demand for freshwater also increases, resulting in an increased drawing of groundwater through wells.
- This increased in drawing of groundwater causes subsidence of the land, causing the ground to be more susceptible to flooding as the land may now be below the previous flood levels and even below sea level.
- Some examples of this include Bangkok, Thailand, and Jakarta, Indonesia, where the increased drawing of water in these cities as a result of increased consumption needs result in subsidence of up to 30cm per year occurring in some areas of Bangkok.

Land use change

- With cities becoming increasingly urbanised, more land is being cleared for large buildings to be built.
- This increase in buildings in cities result in more impermeable land being created, as cement and other material are used to cover up the previously permeable ground.
- As a result, with more impermeable surfaces due to urbanisation, cities are now more susceptible to floods as water cannot infiltrate into the ground as easily.
- This lack of infiltration results in more water pooling on the surface, resulting in higher flood risk from occurring.
- Some examples of such include Singapore, where the huge extent of impermeable land as a result of concrete surfaces has seen an increase in the number of flash foods.

Presence of man-made structures

- In order to manage floods, local authorities and governments have been advocating for the construction of hard flood protective measures.
- Some of these measures may help to manage floods, but on the other hand may cause a worsening of floods in other regions.
- For example, the construction of the Xayaburi dam in the Mekong may bring benefits to the community due to its hydroelectrical power generation, but the presence of the dam disrupts the flow of the river.
- Upstream areas of the dam are flooded as water is accumulated, causing a rise in water level. Similarly, downstream areas are also flooded when water is being released into the downstream sections, causing floods to occur.

Climate change

- With climate changing around the world, the increase in temperatures globally also has an effect on local weather conditions.
- With increase in temperature, there is more air instability.
- This increase in air instability may result in more rainfall happening, as the increase air instability may result in more air rising, causing more precipitation to happen over the area.
- The increase in precipitation may cause heavy flooding over the area, when rainfall intensity is higher than that of infiltration capacity.

Levels marked using H1 Generic Level Descriptors

H1 Generic Level Descriptors for 8m DRQ on Themes 1 and 2

Level	Marks	Descriptors
3	7–8	Response demonstrates clear knowledge and understanding of the context in the question. Uses relevant, detailed and accurate factual information and conceptual understanding. Reflects strong critical thinking skills. Source(s) is well used to support the response. <ul style="list-style-type: none"> • Provides a logical and well-developed evaluation well founded on evidence and/or different viewpoints OR <ul style="list-style-type: none"> • Makes a decision which clearly addresses different elements of the issue and/or interests of different stakeholders
2	4–6	A satisfactory response which is generally sound and contains relevant points, but may not always focus on the context in the question. Uses factual information and conceptual understanding that is generally relevant to the given context but lacks detail and may contain some inaccuracies. Displays general critical thinking skills. Source(s) is used to support parts of the response. <ul style="list-style-type: none"> • Provides an evaluation, which may be limited in depth and insufficient evidence and support used OR <ul style="list-style-type: none"> • Shows some attempt to address different elements of the issue and/or views of different stakeholders when making a decision but is not well-developed or exemplified.
1	1–3	Response shows a poor understanding of the context in the question. Uses basic factual information and conceptual understanding which has some, but limited relevance to the question. Source(s) is not used or not accurately used to support the response <ul style="list-style-type: none"> • Provides little or no evaluation OR <ul style="list-style-type: none"> • Evidence of decision-making, if present, are simple and may be flawed and contains no reference to views of stakeholders
0	0	No creditworthy response.

Examiner comments:

- Candidates need to be mindful of the need to explain the given factor (tropical cyclones) first, as the lack of explanation of the given factor may result in a loss of credit in their answers.
- In addition, there were candidates that did not explain clearly how tropical cyclones lead to floods. Candidates need to be clear of the gaps and links in their explanation, to ensure that they receive maximum credit in their answers.
- Candidates also need to be mindful to use and refer to data from the question, as a lack of reference to the data may cause a loss in credit.

<p>3(a)</p>	<p>Explain the causes of contemporary climate change in countries at low levels of development.</p> <p>In this question, candidates are to explain what causes climate change in our current context, and in particular reference it to countries at low level of development. Candidates must also recognise the difference in natural and anthropogenic causes of climate change, and be able to expand on the term contemporary and refer it to anthropogenic recent causes.</p> <p>Stronger candidates are able to bring in relevant examples and case studies to substantiate their claims.</p> <p><u>Indicative content:</u></p> <ul style="list-style-type: none"> ● Increase in atmospheric carbon: Burning of fossil fuels / coal for energy <ul style="list-style-type: none"> ○ LDCs require energy to fuel their development, be it for transport (petrol), cooking (coal or LPG/LNG), electricity generation and other means. ○ The burning of fossil fuels for such purposes generates a release of carbon dioxide and carbon monoxide, all of which are greenhouse gases. ○ With the increase in consumption of fossil fuels, there is a corresponding increase in greenhouse gas release into the atmosphere, which results in more heat being trapped. ○ This causes global temperature averages to increase, bringing about climate change. ○ Some examples of these include China, which burns huge amounts of coal for its domestic energy use. ● Increase in greenhouse gas concentration: Deforestation <ul style="list-style-type: none"> ○ Land in LDCs are cleared, with trees being cut down, either for resources (timber, wood) or to clear land for development. ○ Trees and vegetation undergo a process known as photosynthesis, which takes in carbon dioxide, a greenhouse gas, and releases it back into the atmosphere as Oxygen. ○ With the reduction in tree cover, there is less photosynthesis occurring in the region, resulting in more carbon dioxide present in the atmosphere. As carbon dioxide is a greenhouse gas, this results in an increase in global temperatures, leading to climate change. ○ In addition, with the exposure of the land to atmospheric heat and air, there will be more oxidation of the soil. ○ This oxidation will result in a release of sub-surface carbon into the air, causing an increase in carbon which will react with oxygen to form carbon dioxide. ○ These two processes act together as a result of deforestation, which results in global increase in temperature. ○ One such example is that of the Amazon rainforest, where large swathes of land are being cleared not just for timber to be exported, but also for forests to be converted for agricultural purposes. ○ In the process of forest clearance with minimal effort and financial cost, slash 	<p>[9]</p>
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and burn is practised, for example in many parts of Southeast Asia, particularly in Indonesia and Malaysia. Combustion of this type of organic fossil fuel adds more greenhouse gases into the atmosphere.

- Locations with large tracts of forest lost include the Amazonian forest (resulting from land clearance for cattle ranching and cash crops like soy bean and oil palm), and in Southeast Asia to cater to the needs of the growing population for housing, industries, and cash crops like oil palm.
- Change in land use: Urbanisation
 - Urbanisation is the process where cities undergo a rapid transformation from rural low level built up areas to huge areas of concrete buildings.
 - When more buildings are built up in a city, it creates two effects: increase in energy consumption, and a change in local climate (urban heat island)
 - With more energy required to sustain the needs of the city, there will be an increase in burning of fossil fuels to generate electricity. This results in an increase in the overall carbon dioxide levels in the atmosphere, which will correspond to an increase in the global temperatures experienced by the city.
 - In addition, with more concrete buildings present, there will be more heat retention on the surface, resulting in surface temperatures increasing. This will lead to an increase in surface temperatures, which will have a knock-on effect on the atmosphere.
 - One such example of a city that experiences the urban heat island effect is that of Singapore. With a highly urbanised environment, Singapore has been heating up rapidly, with our mean annual temperature increasing year on year, having the highest recorded temperature seen in 2017.
- Change in land use: Irrigation, agriculture, and dams
 - With agricultural processes becoming more streamlined, there is an increase in more structured irrigation systems being developed.
 - This creates a need for large water bodies to be built via the process of reservoirs and dams for the purposes of agriculture.
 - With such large bodies of water, the local albedo factor and number is altered, causing a change in local climate.
 - Having large amounts of water will also result in an enhancement of local evaporation and transpiration rates.
 - This change in local evaporation and transpiration rates, coupled with the difference in albedo, may result in an alteration of the formation of clouds, resulting in climate change.
 - The large dams in the tropics are often formed through the drowning of large extensive tracts of tropical forests. These drowned vegetation rot and releases GHGs.

Levels marked

H1 Generic Level Descriptors for 9m SEQ sub-part (a)

Level	Marks	Descriptors
3	7-9	Response is consistently analytical and explanatory rather than descriptive. There is a clear focus on the question. Depth of relevant knowledge and understanding exemplified throughout. The response is coherent and the use of terminology is accurate.
2	4-6	Response includes analysis and explanation but is generally dominated by description for weaker responses. Response reflects relevant knowledge and understanding of the question. Response is structured and organised satisfactorily but may be unclear in parts. Use of terminology is generally accurate.
1	1-3	Response does not address the requirements of the question fully. Depth of knowledge and understanding shown is limited. Response is generally fragmentary and lacks a clear structure and organisation. There may be many unsupported, brief or incomplete assertions and/or arguments with some inaccurate use of terminology.
0	0	No creditworthy response.

3(b)

Discuss the effectiveness of different strategies in managing climate change.

[16]

Candidates are to first explain the various strategies taken to manage climate change. Examples and case studies should be used to support their claims. Stronger candidates, when evaluating the effectiveness of strategies, will take heed of how the strategies are effective at different scales and compare the strategies' effectiveness on how it impacts on the different groups of people. Candidates could suggest that since it is difficult to attain high levels of effectiveness on the a global scale, it may be necessary to implement mitigation at the local scale, and furthermore, it must be complemented by strategies that combat the impact of climate change through adaptations.

Indicative content:

- Adaptation: Improving of flood defences
 - With climate change, there will be a resultant melting of ice caps, causing a rise in sea levels. In addition, the increase in heat will also cause water bodies to undergo expansion, resulting in sea level rise.
 - Furthermore, with climate change setting in, there will be more frequent occurrence of extreme weather events such as hurricanes, which will bring heavy precipitation.
 - As such, due to the increase in onset of flooding, countries have been trying to improve their flood defences either through hard engineering methods of constructing flood walls and levees or soft engineering methods of educating the citizens to manage the negative impact of floods as a result of climate change.
 - One such example is that of Maldives. Being low lying, the country has been actively shoring up its coastal defences, increasing the height of its seawalls to manage the negative impacts of sea level rise on the country. High income countries like Singapore and the Denmark for examples, have the advantage of wealth as they implement their climate change adaptations.
 - LIMITATION: However, such strategies are not long-lasting, as when sea levels rise above the maximum capacity of the strategies, flooding will still occur. The only solution is to constantly keep increasing the height of the seawalls which is unsustainable. And for countries like Bangladesh and Tuvalu, with low income, and being very low-lying, the adaptation could eventually be to abandon the flooded areas.
- Adaptation: Changing crop cultivation to more drought resistant crops

- With an increase in global temperatures, there may be more dry spells occurring as a result of climate change.
- Dry spells would result in agricultural crops reliant on water being affected. The reduction in crop yield may result in a decrease in global food supply, which in serious cases may lead to famines. The need for food security forces many countries to consider this approach.
- As a result, countries have started to either change to more drought resistant crops (crops which need less water), or develop genetically modified crops that are able to be more drought resistant.
- One example is that of the change of maize crop variety in USA. Due to changes in precipitation pattern, the change to a more drought resistant variety of maize in USA has resulted in a drop in economic losses for farmers as a result of dry seasons, proving that such adaptations are useful.
- LIMITATION: However, such crop varieties and change in agricultural methods are expensive, and LDCs may not be able to afford such technologies, resulting in them still suffering from the climate change impact on their crops.
- Mitigation: Transborder cooperation
 - With climate change being an issue that is not localised to an area but a global situation, there is a need for greater cooperation among countries across political borders.
 - There are increasing calls for countries to work together, and some cooperative strategies are that of protocols and treaties between countries to work towards reducing emissions.
 - Such treaties bind countries to concrete targets and strategies to reduce their carbon emissions, thereby reducing the impact of greenhouse gases on our climate.
 - There are a few treaties drafted (Copenhagen Agreement, Kyoto Protocol), but the most recent one is the Paris Agreement. The Paris Agreement sets concrete targets for countries to reduce their greenhouse gas emissions through a series of actionable policies. Majority countries in the world have signed to the agreement, and this is effective in combating climate change.
 - LIMITATION: However, such agreements and cooperative partnerships may not always be effective, as some countries may not join in the accords. One such example is that of the USA, where they have still yet to rectify the Paris Agreement, limiting the overall effectiveness of the efforts.
- Mitigation: Carbon pricing, carbon tax
 - With carbon being the main source of global warming, given that it can bond to form CO₂ and CO, there are strategies to reduce the release of carbon by taxing its release.
 - Carbon pricing and carbon tax are strategies to increase the operating cost for firms who are discharging carbon into the atmosphere as part of their process. Firms have to buy carbon credits before they can discharge gases, which incentivises firms to either reduce their carbon consumption or use clean production processes

- After the implementation of such taxes, firms have been observed to reduce their carbon emissions. For example in Australia, the implementation of the carbon tax has resulted in an overall reduction of up to 17 million tonnes of carbon, proving its effectiveness. Similarly, in the UK, coal use plummeted after the carbon tax in 2014 and in the second year of the carbon tax, GHG emission dropped by 1.4 %.
- LIMITATIONS: However, firms that are rich enough and have the financial muscle may not ascribe to the carbon tax, and instead choose to continue releasing carbon into the atmosphere, paying the large tax. This thus renders the policy ineffective. Unfortunately, in UK, just like Australia and France, when there is bi-partisan politics, and politicians need to win vote, the carbon tax is abolished shortly. France, for example withdraw the tax after backlash from voters angry about rising energy prices which started the prolonged street protests of the 'yellow jackets'.
- When carbon tax are imposed, it also increases the cost of production, and countries that impose this tax, will be faced with reduced global competitiveness for their goods and services.
- Alternative energy sources: Solar, HEP, Wind
 - With the main source of energy coming from burning of fossil fuels which results in a release of carbon dioxide into the atmosphere, there have been calls to change to more green energy sources. Examples of these energy sources include solar energy, hydroelectric power and wind energy.
 - Countries have been slowly changing to such alternative forms of energy, due to the need for more sustainable energy sources given that our fossil fuel reserves may run out anytime. Coupled with the lack of carbon emissions when using such green energy sources, the benefits of such methods of power generation are what attracts countries to it.
 - One example of such an energy source is that of the Three Gorges Dam in China. The construction of the dam has allowed for not just a management of flooding in the area, but also generated immense electricity for the area, of up to 22,000 megawatts in 2016.
 - LIMITATION: However, as much as these strategies are effective, the huge start-up cost for these strategies are a big stumbling block for countries who aim to implement it. LDCs are less likely to implement such strategies due to the huge cost involved, and instead still rely on fossil fuels which increases carbon emissions.
 - Tropical dams: It was found that large tropical dams produced up to 20 times more methane than temperate ones during times when water level is low. Some researchers estimated that in 2007, methane from dams is responsible for 4% of human-caused climate change, and it was found that the Balbina Dam in Brazil produced 10 times more greenhouse gas emissions per unit of energy produced than coal.
 - With the loss of large tracts of tropical forests drowned by the waters of dam, it reduces the size of the carbon sink with this process of deforestation.
 - When biofuel is used as the alternative energy, two complications arise

which reduces its effectiveness as an alternative energy source. First, biofuel from crops like sugar cane or oil palm often comes through the clearance of land through deforestation (once again reducing the carbon sink of forests). Second issue is that often land for food crop may be overtaken by cash crops for biofuel, and this leads to the issue of loss of cropland for food and loss of food security.

- REDD+
 - While cutting down the emission of GHGs is one major mitigation strategy for climate change, another is reduce the loss of the carbon sink, and in some countries, through reforestation and afforestation, to increase the carbon sink.
 - This is done through incentives being offer by the international community to countries and land owners in exchange for slowing down deforestation, and carrying out activities that promote reforestation and sustainable forest management.
 - Examples with some successes include the agreement between Norway and Brazil where deforestation slowed down significantly between 2005 and 2014. Unfortunately, with a change of President, with an agenda that favours economic development over conservation, there is roll back on conservation initiatives across the country, and rates of deforestation has gone up again. Currently (2019) large tracts of the Amazon forest is on fire with very meagre effort from the Brazilian authorities in fighting it.
 - Another example of REDD+ is the agreement between Norway and Indonesia, where in early 2019, Norway announced that it will provide payment to Indonesia as part of the REDD+ agreement the two nations signed in 2010. In was found that in 2017, Indonesia experienced a 60% drop in primary loss compared to 2016.

Candidates are to evaluate the effectiveness of each strategy, and assess how the different strategies can complement each other for better mitigation of climate change.

Note that list is not exhaustive, and other factors may be accepted if well explained.

H1 Generic Level Descriptors for 16m SEQ sub-part (b)

Level	Marks	Descriptors
4	13–16	Response shows strong evaluative elements. Evaluation is relevant and comprehensive. Response fully addresses the question and features accurate knowledge, reflecting depth of understanding. The argument or discussion is coherent and well-supported by relevant material. Use of terminology is accurate.
3	9–12	Response displays a sound evaluative element. Response addresses the question and features accurate knowledge, reflecting depth of understanding. The argument or discussion is coherent and supported by relevant material. Use of terminology is relevant and mostly accurate.
2	5–8	Response has some elements of evaluation but is broadly descriptive. Response exemplifies knowledge and understanding of the question and is generally relevant. The weakest responses may lack balance and/or depth. Response structure is broadly coherent but may lack clarity. Use of terminology is inconsistent though generally accurate.
1	1–4	Response shows little or no evaluation. Response lacks focus on the question and may be largely irrelevant to it. Response is fragmentary and lacks clarity. There may also be unsupported assertions and/or arguments with limited or no use of terminology.
0	0	No creditworthy response.

4(a) Explain the role of climate in affecting the flows and stores of the hydrological cycle in the humid and arid tropics.

[9]

Candidates are to explain the hydrological cycle, and what are the various flows and stores of the hydrological cycles. After explaining the flows and stores, candidates are to compare the difference in the flows and stores between the humid and arid tropics, and explain how climate (temperature and precipitation) has an effect on the flows and stores of the hydrological cycle.

Indicative content:

- Precipitation affecting flows
 - Humid areas: generally experience higher precipitation
 - With higher precipitation, there is more moisture and water present on the surface and the subsurface
 - Sub-surface flows: More interflow, throughflow and groundwater flow as there is more moisture moving downwards (percolation) through the soil profile
 - Surface flows: Due to high precipitation and presence of moisture, there is higher amount of overland flow present. Saturation Overland Flow (SOF) may be dominant due to the high amount of moisture in the hydrological system. (Link this to the role played by the dense vegetation cover – provides interception, prevents rainsplash and inwashing of fines, prevents soil compaction, passages into ground via the roots, and humus -> good soil structures; all these leads to high infiltration and low generation of overland flow).
 - Channel flow (river discharge) for the humid tropics tends to be perennial where there is flow all through the year. For the locations with Am or Aw climate, channel flow is still perennial but the discharge will vary accordingly with the wet and dry season of the location.
 - Water table is generally higher.
 - Arid areas: generally experience lower precipitation
 - With lower precipitation, there is less moisture and water present in the surface and the sub-surface.
 - Sub-surface flows: There is a lack of sub-surface flows, as there is a lack of precipitation which results in a lack of moisture present in the subsurface. Interflow and throughflow are almost non-existent, while groundwater flow is more dominant in arid areas
 - Surface flows: Due to low precipitation, there is a lack of moisture, and coupled with the geology of the area may account for the lack of infiltration processes in the area.
 - The lack of infiltration process may result in a rise in Hortonian overland flow (HOF) when rainfall events happen, and this is the dominant overland flow process in arid areas.
 - Channel flow is ephemeral where river discharge will only occur during and a short while after the rare storm event, and there is no channel flow for the rest of the year (ie, the channel is dry).

	<ul style="list-style-type: none"> ▪ During the rare times where there is rainstorm event, flash floods occurs • Precipitation affecting stores <ul style="list-style-type: none"> ○ Humid areas: higher precipitation, higher water stores <ul style="list-style-type: none"> ▪ With higher precipitation, humid areas tend to have more groundwater flow, and this would equate also to an increase in the water table level due to more percolation as a result of higher precipitation ▪ In addition, with high precipitation, surface stores are generally higher, as evidenced by the perennial streams and surface stores in humid areas. ▪ Higher antecedent soil moisture. ○ Arid areas: lower precipitation, low water stores <ul style="list-style-type: none"> ▪ Having lower precipitation, arid areas tend to have low groundwater flow, and the water table is generally much lower than that of the humid areas. ▪ In addition, there is a lack of surface stores in arid areas, as seen in the presence of ephemeral streams which exist only during rainfall periods. This is evidence of the lowered water table in arid regions, as compared to that of the humid areas. ▪ Little or no antecedent soil moisture. • Temperature affecting flows and stores <ul style="list-style-type: none"> ○ The main impact temperature has on flows and stores is on the evapotranspiration rates in the hydrological system. <ul style="list-style-type: none"> ▪ Arid areas: higher temperatures, resulting in higher evapotranspiration loss of moisture in the hydrological system ▪ Humid areas: slightly lower temperatures, resulting in more moisture present in the hydrological system. <p><i>Candidates may choose to include case studies to elaborate more on their explanations.</i></p>	
<p>4(b)</p>	<p>‘Hard-engineering strategies are the most effective in managing floods.’ How far do you agree with this statement?</p> <p>Candidates should evaluate the various strategies critically in this question. There are a variety of strategies in managing floods, and candidates should not overly focus on the number of strategies present, but rather on how they help to manage floods.</p> <p>Higher level responses will draw on soft-engineering strategies in management of floods, and evaluate on how various strategies must work hand-in-hand for greater effectiveness in management of floods.</p> <p><u>Indicative content:</u></p> <ul style="list-style-type: none"> • Hard engineering methods: Channelisation 	<p>[16]</p>

- Channelization refers to the process where river channels are altered either through a straightening of the channels or smoothing of the channels.
- Such processes help to increase the velocity of the flow of water, preventing floods from happening easily as runoff is diverted away from flood prone areas to open water bodies.
- One example of that is Singapore, where our canals and waterways are constantly smoothed with concrete and lined in a trapezoidal shape to increase flow velocity, reducing the risk of flood to our city.
- LIMITATION: Such methods may prove to be costly, and may need regular upkeep and maintenance due to the wear and tear experienced by river channels. As such, some cities may end up having smoothed channels, but lack the political will and money to upkeep it, resulting in a limitation of the effectiveness of such strategies.
- Hard engineering methods: Levees and embankments
 - Levees and embankments refer to raised mounds of either concrete or soil on river banks to increase the carrying capacity of rivers.
 - Levees are effective in containing flood waters, as the increase in floodwater capacity may help prevent overflowing of water to the surrounding areas, reducing the impact of flood to such locations.
 - One such example of levees and embankments is that in New Orleans, where there are levees lined up all along the water edge of Lake Ponchartrain, which help to keep the increase in floodwater out.
 - LIMITATION: However, levees and embankments have their own limit in the carrying capacity, and an overtopping of the levees and embankments may result in more severe economic losses. In addition, the presence of levees may also result in the levee effect, where people are lulled into a false sense of security and stay near the levees, which would cause more devastating damages when floods do happen.
- Hard engineering methods: Man-made stores and diversion of water
 - To prevent water from flooding an area, there are man-made structures (dams, water detention tanks) built to help divert water away from the flood prone regions.
 - Such structures help to prevent floodwaters from reaching flood prone areas rapidly. For example, dams such as a Xayaburi dam in Myanmar can help to retain water upstream, preventing flooding from happening immediately downstream. There is an element of control over the release of water, helping authorities to manage flood in areas.
 - One example of this is the Stamford Detention Tank in Singapore. The detention tank acts as an additional store of water, helping to divert water away from the main canals into the detention tank, to be released when the rainfall event is over, helping to prevent floods.
 - LIMITATION: Such methods are highly costly and expensive, and lower income countries may not subscribe to such methods due to the high startup cost.
- Soft engineering methods: Risk mapping of flood prone areas

- Flooding only occurs in low-lying areas near water bodies, and a mapping of such areas allows for risk management strategies to be planned specific to area.
- Such targeted measures allow for specific strategies to be devised for specific areas, increasing the overall effectiveness of the management strategy and developmental needs.
- Areas prone to flooding can be earmarked as high risk areas, and authorities can limit the type of development possible at such areas. This will reduce the economic and social impact of floods on the society when floods do happen, as the developments present then are of low value.
- In addition, by knowing which areas are more flood prone, authorities can take a proactive approach to allocate management resources such as emergency response teams to target said areas first in the event of floods.
- One such example of flood risk mapping is that done by the Urban Redevelopment Authority (URA) of Singapore. The URA, in conjunction with Singapore Land Authority (SLA) and Public Utilities Board (PUB), plans the land use of Singapore according to the risk areas, and actively avoids high flood risk areas for high value development.
- Soft engineering methods: Development of flood response teams
 - One way to manage the impact of floods is to have swift response to flood events, managing the floods as effectively as possible early on before the situation exacerbates.
 - When flood events occur, the presence of a response team on-site to direct people and traffic away is invaluable, as it helps to minimise economic loss.
 - Furthermore, with a quick response team on-site, order can be achieved and evacuation of people can be done effectively, helping to minimise the social impact of injuries and deaths.
 - One such example is that of the flood management teams under Public Utilities Board (PUB) in Singapore. With up to 5 teams on the road at any one time, this allows for PUB to respond quickly to flood events, minimising any disruption to the general public during such events.
- Soft engineering methods: Education of the public
 - Knowing what to do during flood events is crucial, and the education of the public on flood responses is key to making flood management strategies work.
 - By educating the public on flood responses and allowing them an insight into the actions they can take, the damages inflicted by flood events would be minimised as the public now knows what to do and what not to do during flood events.
 - One example of this would be the outreach campaigns in Marikina Philippines, where government officials design lesson plan to increase flood awareness tips among the citizens, to minimise the flood impact on the community.

Note that the list is non-exhaustive, and candidates may look to describe other factors

	<p><i>apart from the ones listed.</i></p> <p><i>Examiner's comments:</i></p> <ul style="list-style-type: none"> • The Machchu Dam is useful as a 'cause' case study rather than an example of flood management. The dam was constructed for irrigation purposes, and not flood control; and its failure led to flooding. • Need to provide the accurate definition of hard and soft engineering. • To illustrate the success of hard engineering measures of Singapore, cite the significant reduction in the size of flood areas in the country since we embarked on intense channelization since the 1970s. Include also the Marina Barrage a part of the hard engineering measure although this took place more recently. 	
5(a)	<p>Explain the reasons for the development of urban slums in countries at low levels of development.</p> <p>Candidates are to explain the factors that have led to the development of urban slums. This can range from rural-urban migration to the role of the government. They should also be aware of the context which is focusing on countries of low levels of development.</p> <p><u>Indicative content:</u></p> <p>Population growth due to in-migration and international migration (demographic- social cause)</p> <ol style="list-style-type: none"> 1. In-migration – i.e. rural-urban migration. Often due to rural poverty, most of these migrants have very low financial capacities and find cheap housing within existing squatter settlement. While international migration was not a major factor, in recent years, refugee movements from neighbouring countries into some cities have led to refugee slum development. These slums have even more deprivation than others. 2. Increasing poverty rates amongst some urban residents (economic cause) Slums see the highest concentration of urban poor within one locality. Slum conditions are caused by poverty. The cause-effect relationship becomes confusing. 3. Coupled with inadequate housing response from the government, poverty and government failure becomes mutually reinforcing. LDC city governments are pressured to resolve many issues stemming from rapid urban growth; resulting to growth of urban population being faster than infrastructural growth 4. Poor physical conditions that create low cost housing areas As mentioned as part of the characteristics, the condition of some areas make them unwanted for development for the moment. This allows the development of squatter settlements. Terrain which is difficult to build infrastructure e.g. hilly terrain, 	[9]

	swamplands. Areas that are pollutive and hazardous ☐ e.g. dumpsites, along train tracks	
5(b)	<p>Discuss the challenges in managing non-hazardous solid waste in urban areas.</p> <p>Candidates should evaluate the various strategies critically in this question. There are a variety of strategies in managing non-hazardous waste in urban areas, and candidates should not overly focus on the number of strategies present, but rather on each strategies strength and limitation in managing waste.</p> <p>Higher level responses will draw on not just disposal but also education in management of waste, and evaluate on how various strategies must work hand-in-hand for greater effectiveness in management.</p> <p><u>Indicative content:</u></p> <p>The key strategies to reducing the total volume of waste are</p> <p>(a) Reduce (b) Reuse (c) Recycling</p> <p>Reduce Preventive approach where the key idea is to reduce the possibility of waste generation for example with a technology-driven strategy where leaner production can also be achieved by examining all phases of a product’s life cycle from raw material extraction to its ultimate disposal – so called ‘life- cycle assessment’ or LCA. The amount of waste generated at any each phase will be identified and quantified as an ‘environmental load’. Options for reducing these wastes will be assessed.</p> <p>Reducing consumption campaigns and awareness Socially driven approach to make people aware of their over consumption Especially prominent in DC cities and promoted in schools Global initiative taken on by UN Environment Programme (UNEP), the UN Food and Agriculture Organization (FAO) and partners, the campaign – ‘Think, Eat, Save. Reduce Your Foodprint’ – seeks to accelerate action to eliminate wasteful practices and help countries share successful initiatives on these issues. It specifically targets food wasted by consumers, retailers and the hospitality industry. Evaluation: Takes a longer time to win over people as opposed to using monetary disincentives. However, once people are won over, it’s a habit they will take with them in the long run</p> <p>Reducing industrial waste Using taxation Taxation has been suggested as a possible solution to the widespread problem</p>	[16]

of packaging waste. Imposition of a tax on packaging will effectively incorporate the social cost of a product into the retail price by including the cost of disposal of its wrapping.

E.g. Denmark was one of the first countries to introduce a comprehensive waste taxation scheme to reduce waste in the mid-1980s. The policy was in response to the country's serious waste disposal problem where the per capita generation of waste was among the highest in Europe. Denmark was also running out of landfills and incinerators. The aim of the taxation was to achieve a 54% recycling rate for all waste by 1996 as no tax was levied on waste that is reused or recycled.

Evidence of success: In the ten years from 1987 to 1996, Denmark achieved a reduction of 26% in the quantity of waste delivered to landfills and incinerators and had a recycling rate of 61% (exceeded target). By 2008, the national recycling rate reached 69%.

Evaluation: Is taxation really necessary given that it is a politically unpopular policy? You will see in the next section under 'reuse' that the possibility of profits can encourage the reuse of waste products.

(b) Reuse

Reduces resource consumption by creating a closed loop between output (waste) and input (resource needed). In practice, waste products are reused when it is economically viable to do so and viability is assessed for a number of motives.

E.g. Wastewater is commonly reused in many countries and is widely recognised as a significant and growing water source that is particularly important in drylands. In fact, as population and economic activity increases and freshwater is consumed, the amount of wastewater generated is expected to increase. The use of treated and untreated wastewater in landscaping and agriculture is common in many countries of the Middle East and North Africa including United Arab Emirates, which despite its affluence; also see the economic value of re-using wastewater. Less affluent countries within the region such as Yemen and Syria benefit from the use of wastewater as well. In Mexico, wastewater from almost all cities that have a sewerage system have been used to irrigate about 150,000ha of crops nationally.

Limitations: In some cases, infectious diseases can be transmitted from sewage-irrigated crops to the general public. An outbreak of cholera in the capital of Israel, Jerusalem, in 1980 was thought to be caused by consumption of vegetables irrigated with wastewater. This could, however, have been prevented by limited the use of wastewater to certain crops (fruits and vegetables are less likely to carry disease.)

(c) Recycle

Compared to the past, there are more formalised schemes to recover useful materials. The collection points for materials such as paper and glass have become a common sight.

Crucial factors that determine the success of recycling include the capacity of the

	<p>recycling plant and equipment, the size of the market for recycled materials and government support.</p> <p>E.g. In Toronto, Canada, a local law states that daily newspapers must contain at least 50% recycled fibre or publishers will not be allowed to have vending boxes on the city's streets.</p> <p>LDC-style of recycling:</p> <p>Urban waste economy in Bangalore, India over 40 000 make a living scavenging by waste recovery (re-use) or recycling; representing about 2% of its workforce. Made of mainly women and children, these waste pickers have created a network of waste buyers of newspaper, plastic, glass, metals, clothes and other materials, small dealers, a great variety of enterprises including glass, paper, and aluminium recycling plants.</p> <p>Limitations: While effective in its work, most waste-pickers are women and children with no protective gears or insurance. Socially, these workers are rarely recognised for their work and economically, receive very little.</p> <p>(2) Processing of Waste and Waste Disposal</p> <p>All wastes are disposed into the environment but some enter the environment in a more controlled manner than others. Some wastes are emitted directly from the source without treatment, others are collected and sometimes treated before disposal. E.g. car exhaust can be treated with a catalytic converter that reduces the toxicity of gases produced.</p> <p>Landfills</p> <p>Most commonly used in most countries. About 64% of municipal waste generated in OECD countries was destined for landfills in 1995. The aim is to reduce this to 50% by 2020 with an increase in recycling efforts.</p> <p>Challenges:</p> <p>The key environmental problem we face as a result of landfills is groundwater pollution from leachates.</p> <p>Possible leakage of toxic substances can contaminate surface and groundwater. Groundwater contamination may result from leakage of very small amounts of leachate.</p> <p>If poorly managed, possibility of collapse and/or fire – resulting to unsafe living condition for the squatter settlements living in these sites</p> <p>Incineration</p> <p>Both processing and disposal are involved.</p> <p>Controlled burning of waste at a high temperature designed to attain its complete combustion can be used not only to reduce the bulk of wastes but to also break down hazardous compounds rendering them less dangerous. Incineration can also be used for generating energy.</p>	
6(a)	Explain how urban liveability can be measured in countries at high levels of development.	[9]

Candidates are to explain the different ways to measure urban liveability. It is important that understand the effective assessment of urban liveability is based on objective and subjective indicators. This is because as mentioned in previous section, urban liveability looks at assessment based on the physical built environment and the (more subjective) lived experiences of individuals.

Thus in effectively measuring liveability, these non-overlapping measures should be used to complement each other in providing information on built urban characteristics.. They should also be aware of the context which is focusing on countries of high levels of development.

Indicative content:

Monocle Global Quality of Life Survey

Obj: Since 2007, Monocle, a culture and lifestyle magazine based in London, has compared the quality of life of cities around the globe. As every year, the 25 global cities have been graded on the quality of their community life. Besides the obvious indicators like unemployment rates, easiness to commute, connectivity, housing affordability and safety, Monocle also judges cities on the number of specific attributes: number of bookshops and museums, quality of food, drink and retail, are the cities dog-friendly, can you get a good meal after 22.00 and what is the average ambulance response time.

Score: Ranking based on the various data and opinion is derived

Criteria: Using a combination of both objective data and subjective opinion, a list of the top 25 most liveable cities in the world is derived.

Economist Intelligence Unit (EIU) Liveability Index

Obj: A measure of liveability that has been developed to specifically identify cities that would be attractive to highly-skilled people is the EIU's international liveability ranking.

The overall liveability score and average scores across five broad categories: stability, healthcare, culture environment, education and infrastructure

Score: Index is measured from a score of 100.

Criteria: The EUI Liveability Index considers both objective and subjective indicators.

Living conditions are assessed using about 30 indicators that links the results of subjective life-satisfaction surveys to the objective determinants of quality of life.

Measures look at aspects of stability, healthcare, culture and environment, education and infrastructure.

Neighbourhood Environment Walkability Scale (NEWS)

NEWS assesses residents' perception of neighborhood design features related to physical activity, including residential density, land use mix (including both indices of proximity and accessibility), street connectivity, infrastructure for walking/cycling, neighborhood aesthetics, traffic and crime safety, and neighborhood satisfaction. 67

	items grouped into 8 factors:	
6(b)	<p>To what extent does the social environment contribute to the extent of crowding in urban areas?</p> <p>Candidates should evaluate the various factors critically in this question. In this question, candidates are to explain what causes crowding in urban areas. Candidates must discuss about social environment but also recognise the other factors that contribute to crowding too.</p> <p>Stronger candidates are able to bring in relevant examples and case studies to substantiate their claims. They should also be able to differentiate between factors that affect absolute and relative crowding as well.</p> <p><u>Indicative content:</u></p> <p>Crowding is a concept with both physical and psychological aspects. Objective aspect of crowding: Physical crowding Depends on two variables: Subjective aspect of crowding: Psychological crowding</p> <p>Stand: Social environment is one that causes crowding but there are other factors such as the physical environment, task environment and individual characteristics that play a role in crowding in urban areas.</p> <p><u>Social environment</u> The greater the sense of neighbourliness, the less the perception of being crowded Increasing heterogeneity in an urban population; especially with immigration When immigrants are of a contrasting profile to the dominant ethnic group (e.g. presence of South Asian communities in British cities), xenophobia rises as dominant groups starts ‘feeling’ that their city is getting crowded. Limited spaces for social interaction also creates a perception of being ‘foreign’ or ‘alien’ Spaces for social interaction can be generic ones such as coffee joints/café, restaurants, parks, playgrounds As well as specific ones, like places of worship, ethnic food and clothing outlets, elderly day care centres</p> <p><u>Physical environment</u> Physical density is often seen as an antecedent to other factors in determining crowding</p> <p>Two sub-factors controlling urban density Population size and area (space)</p> <p>Factors affecting population size</p>	[16]

	<p>Migration into cities and natural increase</p> <p>Factors affecting area (space) Physical amount of space available that limits urban sprawl Territorially determined Urban government may limit the extent of the city's boundaries Geographically or environmentally determined Urban design – design , colour</p> <p>Factors affecting task environment These are determined by the capacity of the infrastructure meant for the task E.g. of one task environment: public buses/trains for transportation into and out of the city</p> <p>Factors affecting individual characteristics Personal space preference which varies from person to person Influenced by various personal factors; e.g. age, gender, ethnic or cultural norms, personality (e.g. self-esteem) Attached to the discomfort of sharing a limited space with several people are multiple physical and psychological factors intervening the perception of crowding. Increased anxiety, stress and feeling of exhaustion Perceptions of risk to personal safety and security Feelings of invasion of privacy Propensity to arrive late at work</p>	
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General Rubrics for 9m Essays	
3	<p style="text-align: center;">Marks: 7 – 9</p> <ul style="list-style-type: none"> <input type="checkbox"/> OVERAL MATURITY: Consistently analytical and explanatory essay rather than descriptive one <input type="checkbox"/> Consistently displayed ANALYTICAL SKILLS – some possible analysis include....(some of the following; rather than all) <ul style="list-style-type: none"> <input type="checkbox"/> <u>Categorisation</u>: Response clearly packages answers into coherent categories <input type="checkbox"/> <u>Focus on the question</u> and <u>Links</u>: Clear reference back to question requirements <input type="checkbox"/> <u>Organisation</u>: Presentation of ideas strategic to the question (Q5 Explain why – hence reasons and Q6 Explain challenges; hence presented as challenges) <input type="checkbox"/> CONTENT KNOWL: Adequately displays depth of knowledge and understanding <input type="checkbox"/> CASE STUDY KNOWL: Consistently and effectively uses a <u>range</u> of examples <input type="checkbox"/> PLANNING AND STRUCTURE OF ANS: A coherent answer with well-organised paragraphs and with effective use of an introduction and a conclusion
2	<p style="text-align: center;">Marks: 4 – 6</p> <ul style="list-style-type: none"> <input type="checkbox"/> OVERAL MATURITY: Some evidence of analysis and explanation but lacks depth and/or balance <input type="checkbox"/> Some display ANALYTICAL SKILLS <ul style="list-style-type: none"> <input type="checkbox"/> Basic requisites of analysis are present but inconsistent <input type="checkbox"/> Weaker responses: Align to being more descriptive <input type="checkbox"/> What prevents the access to a higher level – more limited in its analysis <input type="checkbox"/> CONTENT KNOWL: Displays some awareness of appropriate knowledge and understanding but limited in its range or development <input type="checkbox"/> CASE STUDY KNOWL: While answer does bring up some examples, overall there is either limited use of examples or development of examples <ul style="list-style-type: none"> <input type="checkbox"/> What prevents the access to a higher level – limited use or devt such as only uses one named country, details in examples only occasionally illustrate the idea/s raised <input type="checkbox"/> PLANNING AND STRUCTURE: While a structure is present, organisation is unclear in parts or is not strategic
1	<p style="text-align: center;">Marks: 1 – 3</p> <ul style="list-style-type: none"> <input type="checkbox"/> OVERAL MATURITY: Almost entirely a descriptive essay <input type="checkbox"/> Almost void of ANALYTICAL SKILLS; e.g. does not address the question fully <input type="checkbox"/> CONTENT KNOWL: Displays superficial awareness of knowledge and understanding (e.g. mere description of concepts/processes) and lacks depth <input type="checkbox"/> CASE STUDY KNOWL: Superficial or no use of example/s <ul style="list-style-type: none"> <input type="checkbox"/> What prevents the access to a higher level – superficial such as name dropping, mostly giving irrelevant details, wrong use of examples <input type="checkbox"/> PLANNING AND STRUCTURE: Superficial use of introduction and/or conclusion. Haphazard organization of ideas with a lack of coherence
0	<ul style="list-style-type: none"> <input type="checkbox"/> No credit worthy response

General Rubrics for 16m Essays		
4	Marks: 13 – 16	<input type="checkbox"/> OVERAL MATURITY OF ANS: Response is perceptive, logical and has strong evaluative elements <input type="checkbox"/> Consistently displays EVALUATIVE SKILLS – some possible analysis include....(some of the following; rather than all) <ul style="list-style-type: none"> <input type="checkbox"/> Effectively addresses the demands of the question <input type="checkbox"/> Effectively explains ideas using geographical concepts and processes <input type="checkbox"/> Effectively shows the influence, interaction and/or relative significance of various factors/agencies <input type="checkbox"/> CONTENT KNOWL: Displays accurate knowledge and understanding to effectively highlight depth of knowledge <input type="checkbox"/> CASE STUDY KNOWL: Consistently and effectively uses a <u>range</u> of examples that are adequately developed to support ideas raised <input type="checkbox"/> PLANNING AND STRUCTURE OF ANS: A well-organized and coherent answer with strategic development of discussion and with effective use of an introduction and a conclusion
3	Marks: 9 – 12	<input type="checkbox"/> OVERAL MATURITY: Response displays a sound evaluative element <input type="checkbox"/> Consistently displays EVALUATIVE SKILLS – some possible analysis include....(some of the following; rather than all) <ul style="list-style-type: none"> <input type="checkbox"/> Attempts to address the demands of the question <input type="checkbox"/> Attempts to explain using geographical concepts and processes <input type="checkbox"/> Adequately highlights the influence of various factors/agencies <input type="checkbox"/> CONTENT KNOWL: Displays accurate knowledge and understanding to highlight some depth of knowledge <ul style="list-style-type: none"> <input type="checkbox"/> What prevents the access to a higher level – unable to show synthesis between various content areas and/or lack of in-depth explanation <input type="checkbox"/> CASE STUDY KNOWL: Adequately uses a range of examples with relevant explanation and details to support ideas raised <ul style="list-style-type: none"> <input type="checkbox"/> What prevents the access to a higher level – limited in terms not being most appropriate examples and/or explanation <input type="checkbox"/> PLANNING AND STRUCTURE: Well-organized and coherent response that is generally effective
2	Marks: 5 – 8	<input type="checkbox"/> OVERAL MATURITY: While some evaluative elements are present, essay remains mostly descriptive with a relevant focus of the question <input type="checkbox"/> Vague display EVALUATIVE SKILLS <ul style="list-style-type: none"> <input type="checkbox"/> Basic requisites of evaluation attempted but not consistent – e.g. answers that may lack depth or balance <input type="checkbox"/> CONTENT KNOWL: Displays some awareness of appropriate knowledge and understanding but limited in its range or development and/or some inaccuracy in content presented <input type="checkbox"/> CASE STUDY KNOWL: While answer does bring up some examples, overall there is either limited use of examples or development of examples <ul style="list-style-type: none"> <input type="checkbox"/> What prevents the access to a higher level – limited use or development such as only uses one named country, details in examples only occasionally illustrate the idea/s raised <input type="checkbox"/> PLANNING AND STRUCTURE: While a skeletal structure is coherent, org of ideas not well-planned (e.g. some elements of a good intro/conclusion but overall presentation not strategic)
1	Marks: 1 – 4	<input type="checkbox"/> OVERAL MATURITY: Almost entirely a descriptive essay but with a lack of focus on the question <input type="checkbox"/> Mostly void of EVALUATIVE SKILLS – Arguments based on unsupported assertions and/or arguments with little or no link back to the question <input type="checkbox"/> CONTENT KNOWL: Limited or no use of terminology and/or displays superficial awareness of knowledge and understanding (e.g. limited or no use of concepts/theories/processes) <input type="checkbox"/> CASE STUDY KNOWL: Superficial or no use of example/s <ul style="list-style-type: none"> <input type="checkbox"/> What prevents the access to a higher level – superficial such as name dropping, mostly giving irrelevant details, wrong use of examples <input type="checkbox"/> PLANNING AND STRUCTURE: Superficial use of introduction and/or conclusion. Haphazard organization of ideas with a lack of coherence
0		<input type="checkbox"/> No credit worthy response