Section A

Theme 4: Geographical Investigation

1

(a) With reference to Resource 1, describe the main changes made to the river channel, and explain how these are meant to reduce flooding. [5]

Changes	**Reduce flooding because…**
• Vegetation on the river banks have been removed, and replaced by concrete [1m]	Speeds up the flow, such that flood waters can be removed quickly (i.e. more efficient) downstream: • Reduction of friction between water and the banks (i.e. lowers roughness) • Concrete lining prevents bed or bank erosion, lowers sediment load of the river [2m]
• The river has been widened (note that the natural river banks have been "pushed back" to closer to the buildings) [1m]	• Capacity of the river has been increased, allowing more water to be contained within the channel, helping to prevent bankfull discharge from being exceeded [1m]

(b) With the help of Resources 1 and 2, suggest a research question for the group to guide them in their investigation, and briefly explain why it is of a suitable scale. [3]

Possible research question: [1m]

- To what extent has the channelisation at the confluence of Rivers Klang and Gombak reduced the perception of flood risk among users of the area in its vicinity?

Considerations: [not creditable directly, but must be reflected in the research qn]

- *Fixed variable – channelisation*
- *Variable to be tested – perception of flood risk*
- *Where? – Confluence of the rivers*
- *Who? – Users of the area in the vicinity of the confluence (defined here as within 300m radius)*

Why it is of a suitable scale: [2m]

- Geographical area is small, only 300m radius, which is a little over 0.28km^2
- There is sufficient resources in terms of manpower (20 students) that can be divided into enough teams (5 teams of 4) to be spread out within this area
- A total of 4 hours over two evenings is reasonable amount of time to survey 50 members of the public (average one team surveys 5 respondents every evening)

(c) With the help of Resource 2, outline the steps necessary for the students to obtain a representative sample they require for the survey. [4]

There is no fixed way of sampling, but explanations should be given for the suggested approach. Considerations should include:

- Where to conduct the survey (e.g. stratified sampling to select five locations based on characteristics such as distance from the confluence; landuse; etc)
- Who to find as respondents (e.g. a blend of quota and convenience sampling to obtain sampling profile that is reflective of actual population by age, gender, etc)

Level	Marks	Descriptors
2	3-4	Response demonstrates good to very good knowledge of sampling method(s). Outlines a clear plan with reference to data collection, methods, and may consider limitations. Response is relevant to context of question but may lack clarity and coherence for lower end of the level.
1	1-2	Response demonstrates limited or no knowledge of sampling methods. Outline of method 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.

(d) Explain **one** strength and **one** limitation of the data that will be collected using the questionnaire shown in Resource 3. [4]

Strengths may include: [Any one strength well-explained, 2m]

- Breadth of coverage – perception of risk (Q2 to Q4), cause (Q5), suggestions on mitigation measures (Q6), profile of the respondents (Q1, Q7 and items at end)
- Clarity of questions – generally clear, unlikely to cause misunderstanding and hence collect invalid and unreliable information

Limitations may include: [Any one limitation well-explained, 2m]

- There was no question on comparing between the before and after of the channelisation efforts. This is a major limitation because the investigation was intended to investigate whether flood risks have been reduced *because* of channelisation.
- There is an assumption that respondents are familiar with the mechanisms of flooding in the area (see Q5) and thus be able to identify solutions (see Q6)

(e) Evaluate this investigation about flood risk in the area shown in Resources 1 and 2, and explain how it could be improved and extended. [9]

Indicative content:

<u>Strengths</u>

- Flood risk is more commonly understood in terms of whether a river floods frequently and the magnitude of the floods. Investigating through the perceptions of the public is often overlooked, so this investigation will contribute a very useful piece of information from the users' views.

<u>Limitations</u>

- However, studying only the perception of the public makes it a very narrow study. Flood risk of an area extends beyond perception of the public.
- Difficult to obtain perceptions of respondents who have lived in the area before and after channelisation.

<u>Improvements and extension</u>

- To more fully meet the investigation's objective to ascertain flood risk of the area, there are other considerations, including flood recurrence history stretching to in the 1970s, climatic data, landuse change over time, infiltration rates, etc
- Flood risk study could consider the various social, economic and environmental costs that could be brought to the area
- Channelisation in this area may result in flooding further downstream, so a study can be carried out for lower stream areas.

Theme 1: Tropical Environments

Cyclone Megi and Mass Movement in the Tropics

2 Resource 4 shows the forecasted rainfall for a region in East Asia, following the predicted path of Cyclone Megi in September 2016. Resource 5 outlines the various factors that affect the development of a tropical cyclone. Resource 6 shows rescue efforts following a mass movement event that was triggered by Cyclone Megi.

(a) With reference to Resource 4, describe the passage of the weather system as Cyclone Megi moves inland. [3]

Point marked, data referencing is expected.

Indicative content:

- As the cyclone develops off the shores of the island of Taiwan (South China Sea), it originates as a cyclone of 74 mph, estimated to bring around 1-3 inches of rainfall.
- As it hits the shores of Taiwan on 27th September 2016, while wind intensity remains unchanged, the forecasted rainfall increases to 3-6 inches.
- Finally, as the tropical cyclone moves towards Fuzhou, China, the tropical cyclone declines in wind speed, slowing down, the forecasted rainfall remains high, with some areas along the coast forecasted to receive 6-9 inches of rainfall.

(b) With the help of Resources 4 and 5, suggest and explain the conditions that have allowed Cyclone Megi to form, and develop over time. [5]

*Response ought to pay attention to both the conditions for the **formation** as well as the **development** over space and time of the cyclones. The best answers will be able to address both. Development should also include the decay of cyclones.*

Indicative content:

- **Warm sea surface**: Sea surface water temperature off the shores of Taiwan must have been above 27°C, which is also highly likely in September even though the overhead sun has shifted towards the equator. The high temp of water to a depth of about 60m (Resource 5) is maintained from heating achieved earlier in June-Aug due to water's ability to retain heat longer.
- **Low Pressure cell**: Air above the warm sea waters will also be heated, forming an intense LP cell which attracts winds from the surround HP areas, due to the pressure gradient. This causes the converging winds spiraling in towards the cell, and forced upwards.
- **Consistent/uniform surface and upper atmospheric winds:** This ensures that the system set up in earlier stages is not ripped apart.
- **Latent heat**: The cooling of water vapour as it rises results in condensation which releases latent heat, providing required energy to continued instability and thus powering the cyclone system. It further fuels and develops the Cyclone, causing winds to increase in strength, until it dissipates when the cyclone strikes the shore as seen in Resource 4. Without a warm water surface to thrive on, the wind speed brought along by Cyclone Megi declined to 39-73mph in Fuzhou and finally becoming a tropical depression of less than 39 mph.

Levels	Marks	Descriptors
3	5	Well-explained and sound answer that acknowledges the conditions for both the formation **and** the development of Cyclone Megi. Resources have been purposefully engaged with to support explanations.
2	3-4	A good answer that acknowledges the conditions for both the formation **and** the development of Cyclone Megi, but Resources must not have been purposefully engaged with to support explanations.
1	1-2	Explanation is likely to have only been restricted to the conditions influencing the formation of Cyclone Megi, **or** its development. Response uses basic factual information and conceptual understanding which has some, but limited, relevance to the question. Resources 4 and 5 are not used or not accurately used to support the response.
0	0	No creditworthy response.

(c) Describe the characteristics of the mass movement shown in Resource 6. [3]

Point-marked. There is no need to identify the specific type of mass movement. Though the description would likely lead candidates to the conclusion that it is likely to be a flow.

- Established channel: By which materials move along the surface of the slope, following the established channels.
- Clear scarp at the head of the slope, leaving behind an hourglass shaped slope.
- Debris at foot of the slope: Sediment fan at the base of the slope comprising of debris of assorted sizes.
- Deformed materials without semblance of the initial materials from the slope.

(d) With the help of Resource 4, explain how Cyclone Megi could have triggered the occurrence of the mass movement event shown in Resource 6. [5]

Indicative Content:

Increase Shear Stress:

- The intense and excessive rainfall (Resource 4: particularly along the coastal regions of Fujian, receiving a maximum of 6-9 inches of rainfall) that accompanies Cyclone Megi would have caused slope saturation.
- With the exceeding amount of rainfall that falls in a short period of time, this increase in the volume of water would have increased the weight of the potentially mobile mass as the pore spaces are filled with water, thus increasing shear stress.

Decrease Shear Strength:

- Upon saturation, the surface tension between water and particles in the sediments will be lost as the water get between the grains and eliminates grain-to-grain frictional contact by increasing pore water pressure, allowing sediments to slide over one another, decreasing shear strength. The mass loses cohesiveness and begins to flow like a fluid.
- Strong winds (more than 74mph in Taiwan and 39-73mph when the Cyclone reaches the coasts of Fuzhou, China) may also have removed vegetation on the slope as seen in Resource 6. The loss of trees and plants what can help to maintain land stability may cause shear strength to decrease. Without the tree roots to hold onto the soil and other vegetation to the bedrock, it is likely that as the soil approaches saturation, there will be little resistance to gravity downslope.

Levels	Marks	Descriptors
3	5	Well-explained and sound answer that acknowledges the combination of a decline in shear strength as well as an increase in shear stress as a result of cyclones which causes the mass movement. Reference to Resources is integrated well.
2	3-4	A good answer that acknowledges how a decline in shear strength as well as an increase in shear stress as a result of cyclones causes the mass movement. Reference to Resources may be limited on lower end of the level.
1	1-2	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. Resources are not used or not accurately used to support the response. Provides little or no evaluation.
0	0	No creditworthy response.

(e) With the help of your own knowledge, evaluate the relative importance of climate and **at least one** other factor in the occurrence of the mass movement event shown in Resource 6. [9]

Response ought to weigh across the importance of climate (role of water and vegetation) with any other factors which might be chosen for comparison (e.g. geological structure, tectonic activities, human activities). Best answers will arrive at a weighed conclusion. Answers may come to a conclusion that other secondary factors like geological structure, anthropogenic factors and tectonic activities will fasten the onset and pace of MM, but the role of climate is still relatively more important. For instance, soil liquefaction caused by seismic shaking will only occur when soils are initially already saturated or tending towards saturation.

Theme 2: Development, Economy and Environment

The Global Supply Chain of Zara

3

(a) With reference to Resource 7, describe the change in the number of European Union suppliers to Zara, and explain **one** reason for the change. [3]

Describe the change: [1m, both trend and support must be cited or else no credit]
Between 2007 and 2012, the number has **decreased** annually, from 689 in 2007 to 457 in 2012.

Possible reason: [2m]

- The cost of using EU suppliers have gone up, or lost competitiveness to cheaper ones elsewhere. This cost relates to factors of production including labour, or raw materials to be used
- The evidence can be seen in the increase in suppliers used in Africa and especially Asia. Asian suppliers have increased from 333 in 2007 to 725 in 2012, moving in opposite direction from the trend seen in EU.

(b) Compare the flows of weekly cargo shown in Resource 7 with those shown in Resource 8. [5]

	Resource 7 (received at ZAZ)	**Resource 8 (sent from ZAZ)**
Cities in the network (How many, and where)	9 cities sending: Seoul, Shanghai, HK, Delhi, Moscow, Dubai, Amsterdam, Bahrain, Dhaka	8 cities receiving: Mexico joins the network Dhaka and Amsterdam are dropped Dubai and Bahrain serve also as transit points, towards HK, although Bahrain is itself a recipient
Weekly volume (Spatial differences)	At least 600 tonnes, with all cities contributing >130 tonnes except for Bahrain (101-130) and Dhaka (<71)	Seoul and Dubai are largest recipients (>130 each) Shanghai and Moscow (101-130 each) HK (about 200 tonnes) Bahrain and Mexico (<71 each)

(c) With the help of Resources 7 and 8, suggest why Zara has increased the use of air transport in its global supply chain. [5]

Remarks:
The hint for this question is in the preamble – "In recent years, Zara has increasingly used air transport in its supply chain in addition to sea and land transport."

Possible reasons: All to do with making more profit.

- **Market-seeking**: Geographical reach into markets far from Spain
- **Speed**: The ability to produce and deliver new goods from suppliers to logistics hub to shops must be quick in the fashion sector
- **Cost**: Economies of scale will help to bring down transport cost

Level	Marks	Descriptors
3	5	Response demonstrates a good understanding of a Zara's market-seeking and profit-seeking motives, and addresses the context presented, that is, comparing between air transport and sea/land in the overall scheme of Zara's operations.
2	3-4	Response demonstrates some understanding of Zara's market-seeking and profit-seeking motives, and will attempt to show how air transport allows Zara to make more revenue and/or lower cost. On the lower end, may not consider the advantages air transport provides over land/sea.
1	1-2	Response provides poor to basic level of understanding of Zara's market-seeking and profit-seeking motives, and may lose the context of the question regarding how air transport is an important strategy in Zara's overall scheme of operations.

(d) With the help of Resources 7 and 9, explain why Zara's large supplier network has both strengths and limitations to its host economies. [6]

Remarks:

- This question is about the possible positive (i.e. strengths and benefits) and negative (i.e. limitations and disadvantages) impacts of a large TNC such as Zara on its host economies.

- However, economic impacts should be prioritised, as the question uses the word "economies". It is possible to gain high credit so long as both strengths and limitations are considered in this dimension alone. The best answers would also address the significance of "large supplier network" in channeling Zara's impacts.

Indicative content:

- **Economic**: (+) FDI, generates employment, economic linkages to local firms, payment of taxes, multiplier effect, transfer of technology, etc; (-) stifle competition from local firms, suppression of tech devt, financial cost to host, ability to switch out of local economies should more favourable conditions exist elsewhere, etc
- **Social**: (+) Projects to help improve welfare of communities such as education and women empowerment, etc; (-) exploitation of labour in terms of salary, working conditions, etc
- **Environment**: (+) Some efforts by TNCs to be more environmentally-conscious; (-) unwelcome change to atmosphere, land and water, not following laws or follow through on regulations; etc

Level	Marks	Descriptors
3	5-6	Response shows a good to strong understanding of Zara's possible economic impacts, demonstrating breadth and/or depth when considering these. There would also be some references to the significance to do with the largeness of its supplier network, but will be weaker at the lower end.
2	3-4	Response demonstrates an adequate understanding of Zara's possible economic impacts, and may include social/environmental impacts. There could be breadth or depth, but at the lower end, the emphasis on economic impacts may be weak, although present.
1	1-2	Response provides minimal or superficial coverage of Zara's possible impacts, regardless of dimensions.

(e) With the help of Resource 9 and your own knowledge, explain the role of media agencies in influencing the actions of TNCs behind well-known brands such as Zara. [6]

Remarks:

- The media agencies featured in the Resource include news agencies (the source of the report) and TV channels (which provided the material reported).
- The question uses Zara as an example, but invites a general explanation of the role of media agencies in influencing the actions of TNCs. However, a strong answer must demonstrate a close reading, and drawing from, Resource 9 rather than treating it as though it wasn't attached to the question.

Indicative content:

- Media agencies play an important role in any economy by garnering support or opposition for those who govern, by highlighting or failing to do so the views and/or sins of industry, by providing a voice for the people or not doing so, and by simply spreading economic information.
- In the case of TNCs, agencies in the media industry can influence them by means such as affecting their reputation.
- For example, the media do play a role in shaping the public image of TNCs, or their corporate managers and directors, and in so doing pressure them to behave according to societal norms, thereby avoiding actions that will result in censure and consumer boycotts.

- Some key points from Resource 9: "slave-labour working conditions", details shared by a worker, figures of salary vs earnings that suggest the extent of exploitation, observations of working conditions, etc

Level	Marks	Descriptors
3	5-6	Response demonstrates good to strong appreciation of the role of media agencies in influencing TNC actions from own knowledge, and draws effectively from the Resource to help illustrate the theoretical reasoning.
2	3-4	Response shows an adequate understanding of how media agencies influence TNC actions. The use of the Resource is present, but not well-integrated.
1	1-2	Response provides little or minimal understanding of the role of media agencies.
0	0	No creditworthy response.

Theme 3: Sustainable Development

Waste Management in Vancouver

4

(a) With the help of Resource 10, explain **one** usefulness and **one** limitation of *ecological footprint* as an indicator of sustainable urban development. [4]

Usefulness: [2m]

- The larger the EF, the less sustainable a city is. In Vancouver, EF is 2.9 gha/pax, which is above the ideal size (1.7 gha) that will help make it more sustainable. It suggests that if everyone uses resources like Vancouver, 2 Earths are required, and clearly, this is not possible.
- The calculation of EF reveals which aspects of resource use could have more scope for reduction. In this case, Vancouver's food consumption is responsible for about half of its EF, so more can be looked into how the footprint linked to food can be reduced. Similarly, the use of paper and plastic, and private transport, all need to be reviewed as possible areas in which Vancouver can reduce reliance on to achieve SUD.

Limitation: [2m]

- The calculation of ecological footprints for cities may obscure the fact that particular groups of city dwellers contribute disproportionately to these footprints. For example, the poorest segment of Vancouver's population would very likely be much less than that of its wealthiest.
- The meaning of EF depends on the quality and range of statistics from which it is calculated. Resource 4 shows us the range of considerations, and it is reasonable to question the reliability of the data for each of the category, such as food and waste.

(b) With reference to Resource 11, describe the projection of Vancouver's waste disposal to 2040 if current waste reduction efforts remain unchanged. [2]

Current waste production: 371,000 tonnes

Projection by 2020 if efforts remain unchanged:
- Could drop to 362,000 but may also rise to 443,000 tonnes

Projection by 2040 if efforts remain unchanged:
- Waste will be increased, to a value in the range of 539,000 to 659,000 tonnes, an increase of 45-77% from 2016.

(c) Explain **three** reasons why it will be difficult for Vancouver to achieve its goal of producing zero waste by 2040, as seen in Resource 11. [6]

Possible reasons [2m each]:
- Reduce waste production is difficult especially in a population that is rich and large. Resource 5 suggests that waste production will actually increase if nothing more is done to reduce them, so the inclination of the city is to produce more waste. Hence, waste reduction is actually "going against the grain".
- Achieving this goal will require alignment across all sectors of society, not just individuals but businesses as well. Mindsets and behavior of everyone can take a long time to change. Use of laws and policies may not sit well with people, and education efforts may only show after many years.
- Infrastructure and technology in waste management may not be fast enough to meet the continued waste production among its citizens.

(d) With the help of Resource 12, explain the extent to which public education as a strategy can help Vancouver to reduce waste. [6]

Indicative content

Helpful - Education aims to change mindsets, and in turn, the behavior of its citizens. Reaches out to a variety of segments in the population. Allows a host of platforms and approaches, such as through posters that can be placed in a variety of places, and also can include elements to reach out to the public and stimulate their imagination. etc

Not very helpful - Whether these messages would ever reach the target audience remains a question (e.g. these posters can be ignored, vandalised, etc). Humans may need more active motivation from the authorities than passive messaging. Other means such as financial incentives to encourage waste reduction, reusing and recycling would be required to complement public education. etc

Level	Marks	Descriptors
3	5-6	Response shows the ability to consider the usefulness of public education from more than one perspective, and is able to explain convincingly why it is only to some extent that this strategy can be relied on. The use of examples, though not necessary, may be a feature in the best answers.
2	3-4	Response offers a balanced account on the usefulness of public education to help reduce waste, although it may be that only one-sided view is presented but explained well.
1	1-2	Response provides a simplistic and one-sided view on the use of public education to help reduce waste. There would be little to none of explanation of its chosen stand.
0	0	No creditworthy response.

(e) Using the resources and your own knowledge, suggest and explain why waste reduction is deemed a major part of Vancouver's plans for sustainable urban development. [7]

Indicative content

- Protecting the **Environment**: reducing EF of Vancouver (currently two times larger than Earth can sustain), addresses climate change and other environmental impacts (pollution, GHGs from decomposition of waste, etc), pushes the city towards circular metabolism
- Contribute to **Economic** well-being: waste can become a resource that support new business opportunities, reducing the need for increasingly scarce materials and inputs; etc
- Benefitting **Society**: Strengthening community connections in a society that is diverse (becoming a zero waste community), recovery of products that are reusable and rescuing food that is edible can provide employment across different segments of society, especially for the lower income groups, etc

Level	Marks	Descriptors
3	5-7	Response considers fully the dimensions (i.e. breadth) that help a city achieve SUD, and shows convincingly how waste reduction contributes to these (i.e. depth). Examples may be used, though not necessary.
2	3-4	Response provides a partial account of the relationship between waste reduction and SUD. May have only breadth or depth.
1	1-2	Response lacks both breadth and depth, and sketchy on why waste reduction has a key role to play in SUD.
0	0	No creditworthy response.