

EUNOIA JUNIOR COLLEGE JC1 Promotional Examination 2023 General Certificate of Education Advanced Level Higher 2

GEOGRAPHY

9173/01

27 September 2023 3 Hours

Structured Questions

Essay Questions

READ THESE INSTRUCTIONS FIRST

An answer booklet will be provided with this question paper. You should follow the instructions on the front cover of the answer booklet. If you need additional answer paper, ask the invigilator for a continuation booklet.

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.

Write your Centre number, index number and name 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.

DO NOT WRITE ON ANY BARCODES.

Answer both questions in **Section A (60 marks)** Answer two questions in **Section B (40 marks)**, one from each cluster.

At the end of the examination, fasten all your work securely together. The number of marks is given in brackets [] at the end of each question or part question.

Section A

Answer **both** questions.

Cluster 2: Tropical Environments

1 Cyclone Batsirai was a deadly tropical cyclone which heavily impacted Madagascar in February 2022 and is one of the strongest tropical cyclones to strike Madagascar. Resource 1 shows global distribution of tropical cyclones. Resource 2 shows the pathway of Cyclone Batsirai from 2 February to 7 February 2022 and its effects on rainfall pattern in the region. Resource 3 shows a photograph of a mass movement which occurred in Madagascar after Cyclone Batsirai. Resource 4 shows a diagram classifying different types of mass movement.

(a)	Describe the global distribution of tropical cyclones shown in Resource 1.	[5]
	 <u>General (Spatial distribution)</u> Generally, tropical cyclones can be observed in the tropical regions between 5°N - 30°N and 5°S - 30°S over tropical oceans. <u>Specific (Spatial distribution)</u> Cyclone pathways observed in Resource 1 generally move from these 	AO2
	 tropical regions towards higher latitudes. There is a greater proportion of tropical cyclones formed at the Northern Hemisphere (69%) as compared to the Southern Hemisphere (31%). 	
	 Specific (Temporal distribution) Specifically, while tropical cyclones in the Northern Hemisphere tend to occur in the later half of the year (e.g. May to November over the Arabian Sea), those in the Southern Hemisphere mainly occur from the late to beginning of the year - from January to March. 	
	 Anomaly (Spatial distribution) An anomaly observed would be that within the tropical region of 5°N - 25°N and 5°S - 25°S, areas such as the western and eastern coasts of South America do not experience any tropical cyclones. No tropical cyclones found in the South Atlantic 	
	Accept any other plausible answers.	
(b)	With reference to Resource 1, explain two conditions necessary for the development of tropical cyclones.	[4]
	Award 1 mark for each condition necessary for the development of tropical cyclones.	AO1
	Award a maximum of 1 additional mark for further development. Presence of warm water (Total 2m):	
	 Tropical cyclones are formed in the presence of warm ocean waters with temperatures <u>above 28^oC</u> which belos generate sufficient evaporation and subsequent warming of the 	
	air above waters. This in turn creates an area of low pressure, subsequently allowing for further convergence of wind from surrounding areas of higher pressure.	

	Presence of deep layers of warm water (Total 2m):	
	 Presence of Coriolis effect (Total 2m): Presence of strong Coriolis effect is important in the formation of tropical cyclones. It helps to spiral winds inward cyclonically at low levels towards the low 	
	pressure area and allows the rising column of air to twist , forming tropical cyclones	
	Accept any other plausible answers.	
(c)	Cite data from Resource 2 to describe the past and forecast track of Cyclone Batsirai from 2 February to 7 February.	[5]
	Award 1 mark for each description of the cyclone track.	AO2
	Award maximum 1 additional mark for further development of each description	
	General trend:	
	 The cyclone generally moved in a southwest direction from the Mozambique Channel and over Madagascar. 	
	Specific:	
	 General increase in speed as it moves southwestwards towards the eastern coast of Madagascar + Data Made landfall along the eastern coast of Madagascar on 5 Feb 12:00 UTC (243km/h) 	
	 Continued to move inland in a westward direction, at rapidly decreasing speeds from 243km/h on 5 Feb 12:00UTC to only 63 km/h on 6 Feb 12:00UTC [1 mark]. During this time, it degraded from tropical cyclone on 5 Feb to a tropical storm on 6 Feb [1 additional mark]. 	
	 Slight increase in wind speeds from 63km/h to 74km/h as it eventually travels off the coast of Morombe 	
 (d)	Explain how Cyclone Batsirai affected the rainfall pattern in Madagascar as shown	
. ,	in Resource 2.	[5]
	Award T mark for each description of the cyclone track.	AUZ
	Award maximum 1 additional mark for further development of each description	
	 Generally, Resource 2 shows that the rainfall levels decrease when a region is further away from the cyclone path + Data This is because the tropical cyclone brings about intense rainfall to the regions it travels pas [1 mark] + Data on distance travelled over Indian Ocean [1 additional mark]. 	

	 However, when it moves further inland, the amount of rainfall received in regions like Manja/Morombe decrease + Data This is because the cyclone has lost significant amounts of moisture along the coastal region where it first made landfall [1 mark]. Furthermore, as it moves over land, the cyclone no longer has a source of warm waters providing the continual supply of moisture and subsequent rainfall to the regions inland [1 additional mark]. 	
 (e)	With reference to Resource 3, suggest why the mass movement has occurred in Madagascar.	[5]
	Award 1 mark for each description of the cyclone track.	AO1
	Award maximum 1 additional mark for further development of each description Award maximum 4 marks if responses do not highlight the condition for	
	mass movement to take place.	
	 <u>Condition for mass movement to take place:</u> When shear stress exceeds shear strength, mass movement occurs. 	
	 Explanation: Intense rainfall during the cyclone event → oversaturation of soils → shear strength decreases [1 mark], as the soils lose its cohesiveness due to increased pore water pressure [1 additional mark] Rainfall also adds weight to the slope materials → increases shear stress [1 mark] Buildings → adds weight to the slope → increases shear stress [1 mark] Road cutting → alters the slope angle → decreases shear strength [1 mark]. When slope angle eventually exceeds the angle of repose, slope becomes unstable and mass movement can occur [1 additional mark]. 	
(f)	Using Resource 4, describe the differences between an earth flow and mud flow	[6]
(1)	 Velocity – Magnitude (2 marks) Generally, mud flow is faster than earth flow (1 mark) + Data (1 additional mark) 	AO2
	 Velocity – Range (2 marks) Earth flow occurs over a wider range of velocities than mud flows (1 mark) + Data (1 additional mark) 	
	Water content (2 marks) Earth flows contain lesser water content as compared to mud flows (1 mark) + Data (1 additional mark)	

- 2 Resource 5 shows the global temperature anomaly from 1880 to 2022 compared to the 1951-1980 average. Resource 6 is a cartoon about challenges in implementing strategies to respond to climate change. Resource 7A shows the normal thermohaline circulation in the Atlantic Ocean and Resource 7B shows the weakened thermohaline circulation in the Atlantic Ocean.
 - (a) Describe two insights that ocean cores provide about past climate variability. [4]
 Award 1 mark for the description of each insight. AO1

Award a maximum of 1 additional mark for further development of this description, where applicable.

Award a maximum of 2 marks for description of one insight only.

Possible responses include:

- One way could be the analysis of isotopic composition of the calcite in the shells and bones of sea organisms deposited on the seabed [1 mark]. This can give evidence of the cyclical warming and cooling in the Earth's climate in the past where a higher composition of ¹⁸O isotopes in the ocean core will be indicative of colder ocean temperatures [1 mark].
- One way could be the study of diatoms found within the sediments which can show how past climate has changed [1 mark]. The changes in salinity in the area due to changes in temperature/rainfall would change the species composition of the diatoms over time and the study of these changes could identify **changes in the local climate**.
- One way could be the study of glacial debris deposited on the ocean floor when icebergs calved from continental glaciers carrying these material melts over the seabed [1 mark]. The changes in the types of rocks found in glacial debris was key in discovering **changes to the Northern Hemisphere ice sheets in past climates** [1 mark].
- (b) Cite data from Resource 5 to describe how the global temperature anomaly has changed from 1880 to 2022.

[5]

Award 1 mark for a description of each global temperature anomaly using data from Resource 1, up to a maximum of 4 marks.

Award a maximum of 1 additional mark for further development of each description, where applicable.

Possible responses include:

General

• The global temperature anomaly has generally increased from 1880-2022 from -0.2°C compared to the 1951-1980 average to -0.89°C in 2022 [1 mark].

Specific

• The period from 1880-1940 was generally cooler ranging between -0.05°C to - 0.49°C compared to the 1951-1980 average [1 mark]. On the other hand, the period from 1976-2022 saw temperatures above those of the 1951-1980 average, ranging between 0.05°C -1°C above average [1 mark].

The greatest anomalies from the 1951-1980 average occurred in 1909 with -0.49°C on the cooler end and 2016 and 2020 with 1°C on the warmer end [1 mark].

Anomaly

marks.

- However, from 1941-1975, there was a fluctuation in global temperatures with temperatures ranging -0.24°C to 0-24°C compared to the 1951-1980 average [1 mark].
- (c) With reference to Resource 6, describe three challenges associated with implementing strategies to respond to climate change. [6] AO2 Award 1 mark for each description of challenges associated with implementing strategies to respond to climate change, to a maximum of 5

Award a maximum of 1 additional mark for further development of each description, where applicable.

Possible responses:

Economic challenges

One challenge is the economic challenges in responding to climate change such as the financial costs involved in mitigation or adaptation strategies [1 mark]. As seen in the cartoon, the government/person of authority does acknowledge the need to address the issues surrounding climate change but upon discovery of the costs involved, retracted his words as it is likely that there are competing demands on the financial resources that he has [1 mark].

Political challenges

The lack of political willpower also represent a challenge in climate change response [1 mark]. Because response strategies typically have high short term costs with benefits only in the long term, there is less political willpower to effect change [1 mark].

Uncertainties over future impacts of climate change

- Another challenge is also the uncertainties over future impacts of climate change as it would be difficult to respond to climate change if the type, scale and intensity of future impacts are yet uncertain or changing [1 mark]. The inability to accurately predict future climate change means current implementation might no longer be relevant [1 mark].
- (d) With reference to Resources 7A and 7B, explain how changes in the thermohaline circulation influenced past temperature variability. Award 1 mark for each explanation of how changes in the thermohaline circulation AO2 influenced past climate variability, up to a maximum of 5 marks.

Award a maximum of 1 additional mark for further development of each explanation, where applicable.

Resource 3A shows the normal thermohaline circulation with a warm surface • flow moving polewards in the North Atlantic and heat being released to the air before sinking and moving equatorwards [1 mark]. This release of heat brings [5]

warmth to the continental mass of western Europe and explains for the warmer periods in past climate [1 mark].

• However, Resource 3B shows the interruption of the thermohaline circulation with an injection of pooled freshwater in the North Atlantic due to the melting of ice [1 mark]. This slows down the thermohaline circulation, as evidenced by the lighter arrows, reducing the heat loss at the surface and hence resulting in cooling [1 mark].

This was evidenced during the Younger Dryas episode during the early Holocene epoch where a sudden input of meltwater from the Laurentide Ice Sheet brought about a sudden cooling of the Earth's climate for about 1400 years [1 mark].

(e) With reference to Resources 5 and 7B, suggest one impact on aquatic and terrestrial ecosystems each due to changes in the Earth's climate.
 Award 1 mark for each suggestion of the impact on aquatic and terrestrial ecosystems due to changes in the Earth's climate.
 Award a maximum of 1 additional mark for further development of each suggestion, where applicable.
 Award a maximum of 2 marks for description of the impacts on <u>either</u> aquatic <u>or</u> terrestrial ecosystems only.

Possible responses:

• The increase in warming from 1976 to 2012 of 1°C seen in Resource 1 could lead to an increase in the occurrence and/or intensity of wildfires [1 mark]. The increase in temperatures can create hot and dry conditions that help fires spread faster, burn longer and rage more intensely leading to a loss of vegetation cover [1 additional mark].

The ice melt leading to the pooling of freshwater in the North Atlantic seen in Resource 3B can have negative impacts on the aquatic life in that area [1 mark]. The change in the salinity of the water would disrupt the ideal living conditions of their habitat leading to a loss in species who are unable to adapt to this change [1 additional mark].

(f) Explain how human activities can influence the global carbon cycle.
 Award 1 mark for each explanation by which human activities influence the global AO1 carbon cycle.
 Award a maximum of 1 additional mark for further development of each

Award a maximum of 1 additional mark for further development of each explanation, where applicable.

Possible responses:

Increase in carbon emissions

- One way that human activities influence the global carbon cycle is by increasing carbon emissions through the burning of fossil fuels for energy [1 mark]. This releases a large amount of carbon into the atmosphere very quickly and significantly at a rate far faster than they are naturally returned to geological storage, accelerating the carbon cycle [1 mark].
- Another human activity that increases the amount of carbon emissions is the rearing of livestock [1 mark]. The decomposition of manure and methane produced as part of their normal digestive processes increases the amount of carbon in carbon flux within the cycle [1 mark].

Reducing carbon sinks

• Human activities also influence the cycle is by reducing carbon sinks such as through deforestation [1 mark]. Forests absorb carbon through photosynthesis

and the clearing of forests for crops or pasture reduces the ability of the area to store carbon efficiently leaving more carbon in the atmosphere [1 mark].

4

Section B

Answer either Question 3 or Question 4 and answer either Question 5 or Question 6

Cluster 2: Tropical Environments (20 marks)

3 Evaluate the success of the strategies used to manage fluvial floods in the humid tropics.

[20]

Possible approaches:

- In many parts of the humid tropics, a multi-pronged approach have been widely adopted to manage the effects of fluvial floods → PMR strategies and its strengths
- While the various strategies employed has its strengths, many of these strategies are often costly and require advanced technologies. As such, they may not be feasibly implemented in certain regions, especially the developing countries.
- Furthermore, given the limited resources available in some of the countries, certain social groups are less likely to have their needs met in the event of a fluvial flood.

- Students may also approach by focusing on case studies, using them to evaluate how floods have been managed in each case study.
- **4** Evaluate the significance of fluvial erosion in the formation of fluvial landforms in the humid tropics.

[20]

Possible approaches:

Candidates could approach this question by evaluating the significance of fluvial erosion in comparison to other geomorphic processes (i.e. fluvial processes; marine processes; weathering etc.).

Candidates may argue that while fluvial erosion can directly contribute to the formation of erosional fluvial landforms such as meanders, other fluvial processes such as fluvial deposition are also significant. Responses may substantiate the significance of other fluvial processes with examples of depositional fluvial landforms such as deltas and braided channels. The responses may also showcase the importance of marine processes in the formation of fluvial landforms such as deltas. The statement can also be evaluated against other geomorphic processes such as weathering, water erosion and mass movement to highlight the *interplay* of various processes in the formation of fluvial landforms. Having that said, students may still contend that fluvial erosion is still the most significant as it ensures the supply of sediments for subsequent transportation and deposition of sediments, which are important for the formation of fluvial depositional landforms.

Cluster 3: Sustainable Future and Climate Change (20 marks)

5 "The impacts of contemporary climate change are largely negative."

Evaluate this statement.

[20]

Possible Approaches:

Candidates could approach this question by making a judgement on whether the impacts of contemporary climate change are largely negative through a consideration of criteria such as temporal scale of the impacts and spatial scale of the impact. Candidates could analyse the contextual factors such as unevenness in changes in temperature and precipitation, differences in vulnerabilities of different groups of people and level of technology and resources, which may have contributed to the impacts being more negative.

Candidates could also approach the question by making a judgement on whether the impacts of climate change are largely negative for certain groups of people more than others through a consideration of criteria such as the temporal scale of the impacts, spatial scale of the impacts and the ability to respond to the impacts.

6 "The state is the main actor involved in responding to climate change."

Evaluate this statement.

Possible Approaches:

Candidates could approach this question by making a judgement on whether the state is the main actor vis-a-vis other actors such as firms and non-governmental organisations (NGOS) through a consideration of criteria such as ability to enact change, speed and impact of strategies implemented and ability to engage various community groups. Candidates could consider both mitigation and/or adaptation strategies. Candidates could also consider the economic and political challenges involved in implementing these strategies.

Candidates could also approach this question by making a judgement on whether the state is the main actor in some contexts than others through a consideration of two or more case studies where the state and at least one other actor are involved. Candidates could analyse the contextual factors such as the resources available to address the challenges, potential trade-offs and uncertainties over the impacts the strategies are meant to address, which may have contributed to the variance in the involvement of different actors in responding to climate change.

- End of Paper -