



19th International Geography Olympiad

Bandung, Indonesia

8–14 August 2023

WRITTEN RESPONSE TEST

Marking Scheme

Instructions for Markers

1. **Check if the iGeo student numbers are on each sheet (on odd pages) before dividing up the Test.**
2. This test consists of 6 sections.
3. The maximum total mark is 90.
The mark for each question is given in the margin at the beginning of the question.
There is a maximum of 15 marks for each section.
4. One whole section per marker and double-checker.
Some lengthy (more than 2 pages) sections may be divided for two marker-pairs.
5. Get the hang of the full range of answers by reading through a few papers with your co-marker before you start your marking.
You can mark together (especially for level marking), or after establishing a consensus on how to mark for thoroughness and consistency, act as each other's double-checkers by marking half of the test and then swapping the pile.
We strongly recommend whenever in doubt, consult your marking partner and, if appropriate, the designated moderator(s).
6. Please develop your own marking/correcting notation system (using +/-, x/0, $\sqrt{\quad}$ marks), underlining, comments etc. to ease double-checking and sample marking.
7. **These answers here are not exhaustive. Credit any relevant answer.**
8. Check whether the answer continues outside the designated area, in the margins or as clearly marked on blank pages.
No credits will be given to answers in the Resource Booklet.
9. The test uses two marking systems: point and level marking.
10. Half marks can only be given where indicated as the total of 90 marks will yield only 40% of the total Olympiad result.
11. Mark only the required number of answers (reasons, examples etc.).
For instance, if the question asks for 2 reasons and there is more than 2, only the first 2 reasons should be marked.
12. Put your final mark next to the question number in the column on the left – it eases the work of the person who has to put the numbers into MS Excel.
Please write your numbers clearly.
13. Please write down any inconsistencies of the Marking Scheme, revisions and additional answers or answers not accepted on the Notes page at the end of the Booklet (e-mail is preferred) and hand them in after marking to improve the final Marking Scheme that will be uploaded to show the actual marking.
14. The moderator(s) will sample the marking of all teams.

Command Terms for use in Written Response Test

Terms	Meaning
Analyse	break down the content of a topic, or issue, into its constituent parts in order to provide an account of it
Annotate	add labels with short comments to a diagram, map or photograph in order to describe or explain
Describe	give a factual statement of the distinctive features of something, e.g. for a landform, its shape, dimensions, composition, location (do not explain)
Discuss	give a thorough account from different points of view
Draw	make a clearly defined diagram, flowchart or map, and include labels
Elaborate	give further detail
Estimate	approximately calculate the number
Explain	give a reason, a cause, an effect, a consequence for why or how something happens
Evaluate	consider several arguments or options and come to a conclusion about their importance or success
Forecast	predict or estimate (a future event or trend)
Identify	name, select, point out something
Justify	provide sound reasons or evidence on which your response is based
Label	add names to a map, diagram, sketch or table
Match	put something together with something else that is appropriate or related
Name	state or specify, using a word or words by which something is known
Outline	give the main points or general principles of something, omitting minor details, and usually emphasizing structure and relationships
Specify	identify clearly
Study	look closely at the details in
Suggest	put forward an idea or a reason
With the help of the information provided	base answer partly on information provided (refer to this material) and partly on own knowledge

In level marking in order to credit higher marks the response has to cover a multi-perspective view with a range of factors/impacts from different spatial and temporal scales forming a thorough and well-elaborated account.

Section A: The Aral Sea

Resource Booklet Box A1 provides historical information regarding the Aral Sea region. Resource Booklet Figure A1 shows Central Asia with the location of the Aral Sea. Resource Booklet Figure A2 contains Landsat satellite imagery showing changes of the Aral Sea (1964-2022). Resource Booklet Figure A3 shows changes in Precipitation of the Aral Sea 1955-2015. Resource Booklet Figure A4 shows changes in Salinity of the Aral Sea 1955-2015.

2 m

1. Describe the drainage pattern surrounding the Aral Sea and name any appropriate technical term(s) that apply.

Point marking.

Suggested answer for the **description of the drainage pattern**:

- A closed system hydrologically speaking
- All the water which entered the Aral Sea, stayed there.
- The only way water was lost was via evaporation and slow seepage into the ground.
- There are no rivers, streams, or underground outlet channels for the water.

Suggested answer for the **name of the type of basin**:

- Endorheic (basin)

Award **1 mark** for the for a complete description of the drainage pattern.

Award **0.5 marks** for an incomplete description of the drainage pattern.

Award **1 mark** for the term endorheic (basin).

Accept any other relevant and correct answer.

3 m

2. Study Resource Booklet Box A1 and Figures A1 and A2. Using the information provided and your geographical understanding, explain three **economic impacts** due to the changing conditions of the Aral Sea.

Point marking.

Suggested answers:

- The collapse of the commercial fishing industry and related businesses devastated the income and employment levels of towns along the lake.
- Almost complete loss of the muskrat trapping industry in the region.
- The loss of the commercial shipping industry led to direct and indirect job losses in the region. People moved from the area and the related businesses were negatively impacted financially.
- Originally there was an increase in agricultural production due to the irrigation of rice and cotton fields (income from exporting these crops). Over time, there has been a decrease in productivity of soils in the area as they become covered in salts carried by the winds.

Award **1 mark** for each full explanation.

Award **0.5 marks** for listing an impact without an explanation. Accept a maximum of 3 impacts.

Accept any other relevant and correct answer.

2 m

3. Study Resource Booklet Figure A3.

Identify two factors responsible for the trend shown in this precipitation graph of the Aral Sea.

Point marking.

Suggested answers – factors/causes of **decreased precipitation**:

- Decreasing moisture
- Drought
- High evaporation rate
- The Aral Sea is characterized by a desert-continental climate featuring wide-ranging temperatures, cold winters, hot summers, and sparse rainfall.
- Climate is changing in the area as the Aral Sea decreases in size – less moisture content in the region.

Award **1 mark** for each factor identified that relates directly to the cause of decreased precipitation. An explanation is not necessary.

Do not award **0.5 marks**.

Do not award marks for effects of decreased precipitation.

Accept any other relevant and correct answer.

4 m

4. Study Resource Booklet Figure A4.

Explain two **causes** and two **environmental effects** of the trend shown in the salinity graph of the Aral Sea.

Point marking.

Suggested answers – **causes** of increased salinity:

- Decreasing river runoff from diversion of its water for irrigation plus high evaporation rate led to decreasing moisture resulting in drought that eventually caused higher salinity due to chemical erosion of the parent material.
- Micro-climate changes of increased temperatures lead to higher evaporation rates causing higher salinity levels.

Suggested answers – **environmental effects**:

- Higher salt/mineral content killed off the marine life/fish.
- Dust from the dry soil contains high salt/pesticide content – it is then blown onto fields choking them. This requires more fertilizers/pesticides which continues to make the problem worse.
- Local ecosystem destroyed due to the increased salinity.
- Human health effects due to exposure to high levels of chemicals – respiratory disease, greater rates of cancers.
- Economic resources need to get water resource.

Award **1 mark** for each full explanation of causes of increased salinity.

Award **1 mark** for each full explanation of environmental effects.

Award **0.5 marks** for listing each listed cause or effect without an explanation.

Award a maximum of 2 listed causes and 2 listed environmental effects.

Accept any other relevant and correct answer.

5. Study Resource Booklet Box A1 and Resource Booklet Figures A1, A2, A3 and A4.
Explain 4 reasons why solutions for the issues in the Aral Sea region are difficult to implement.

Point marking.

Suggested answers:

- Many countries are in the region (mainly Kazakhstan and Uzbekistan, but regional countries: Russian Federation, Turkmenistan), therefore many different governments with varying perspectives, priorities, and funding levels.
- It is hard to coordinate management strategies between national governments.
- International agreements are difficult to enforce because international laws are not always clear or enforced.
- Low priority on government agendas as there are more pressing issues.
- Question of who is responsible and who will oversee implementing solutions.
- Costly to correct damage – who will pay?
- The problems are too big to solve. This makes it an overwhelming problem with no agreement on where or how to begin/proceed.
- Long-term damage is difficult to correct. The problem has been going on since the 1960's and solutions at this point would have limited impact short and long term.
- High costs for remediation. Governments must set aside large sums of money that could be spent on more pressing issues for the people of their country.
- Lack of political will to solve the problems. Some politicians or countries may say that it is not our problem nor happening to us and therefore they are unwilling to contribute to solutions.
- Geography of the area – less moisture because of river diversions, higher evaporation, and more drought. Micro-climate changes specific to the Aral Sea region.
- Poor infrastructure makes any solutions more difficult

Award **1 mark** for each specified challenge that also includes an explanation (each answer should specify and explain why it is difficult to implement solutions).

Award **0.5 marks** for each specified solution given without an adequate explanation.

Award a maximum of 4 listed reasons.

Do not award general answers without specific reference to the issues of the Aral Sea region (e.g., names of countries, long term issue - dating back to the 1960s).

Accept any other relevant and correct answer.

Section B: Maritime transport

Resource Booklet Table B1 shows UNCTAD port liner shipping connectivity index (PLSCI) in the first quarter (Q1) of 2006 and fourth quarter (Q4) of 2022 in 50 busiest container ports in the world.

Resource Booklet Figure B1 shows Maritime trade by basic type of cargo by world regions 2006-2021.

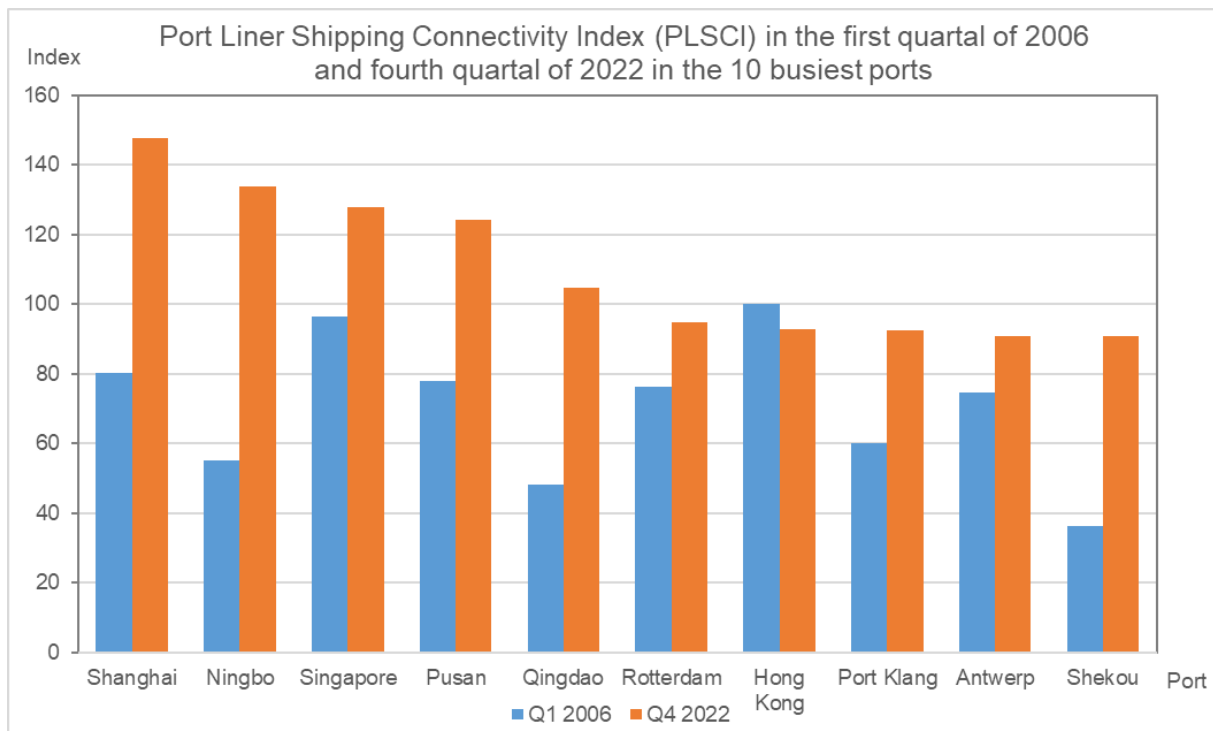
Resource Booklet Figure B2 shows Finnfjord Port Project in Iceland.

5 m

1. Study Resource Booklet Table B1. Use an appropriate data representation method to show the Port Liner Shipping Connectivity Index (PLSCI) in 2006 (Q1) and 2022 (Q2) for the **ten highest ranked container ports in 2022**.

Point marking.

Suggested answer:



Award **2 marks** for appropriate diagram. It can be vertical (as above) or horizontal. Values have to be ordered from highest to lowest (or vice versa), with no empty space on axes and drawn using a ruler (or precisely by hand).

- 0.5 marks are subtracted if values are not ordered from highest to lowest (or vice versa)
- 0.5 marks are subtracted if there is empty space on x/y axis with no values (i.e. if the axis is longer than needed)
- 0.5 marks are subtracted if the diagram is not drawn using a ruler or very precisely by hand
- 0.5 marks are subtracted if values are not plotted accurately (check visually a couple of high and low values). Allow for small amounts of rounding to suit the scale.

Do not award any marks for any other type of diagram as it is not the most appropriate for the data and a key skill is for students to select the most appropriate type for the data.

Award **3 marks** for the following elements – **0.5 marks** for each of the following elements that have been drawn correctly:

- **0.5 marks** for suitable title (must have reference to PLSCI (what) and years (when)).
- **0.5 marks** for the names of the countries on the x axis (or y axis on the bar diagram). The general label “port” may be omitted.
- **0.5 marks** for the label “Index” or “PLSCI” or “Port Liner Shipping Connectivity Index” on the y axis (or x axis on the bar diagram). The label can be placed horizontally as displayed or vertically.
- **0.5 marks** for accurately displayed values on y axis (or x axis on the bar diagram).
- **0.5 marks** for expressing values for 2006 and 2022 in a different way (e.g. different colours of bars/columns).
- **0.5 marks** for a legend that contains colour and year of each displayed category.

Accept any other relevant and correct answer.

2 m

2. Study the Resource Booklet Table B1 and Figure B1 and the diagram in Question B1. Identify two spatial and/or time-related patterns of international **tanker freight trade** and explain them.

Point marking.

Suggested answers:

- Main export regions are (South) West Asia, Africa, Latin America and Europe (Russia) - export regions have natural resources (oil and gas) that exceed their own needs.
- Main import regions are East Asia and Europe (and North America) - import regions have high population and economic production.
- Decline in tanker discharges in North America 2006-2021 - growth in production in the region replacing imports and enabling exports.
- Generally stable volume of tanker trade compared to dry cargo growth 2006-2021 - lower growth in crude oil production and consumption compared to coal and growth in other products and modes of transport (especially container ships).
- Short-term disruption of imports and exports in 2020 (especially in Europe) - lower demand for fuels due to the COVID -19 pandemic and restrictions on mobility.

Each answer should include either spatial or temporal pattern and a brief explanation.

Award **1 mark** for each identified pattern accompanied with an explanation.

Award **0.5 marks** for each identified pattern without an explanation.

Award a maximum of 2 listed patterns.

Accept any other relevant and correct answer.

2 m

3. Study Resource Booklet Figure B2. Using the information provided and your geographical understanding suggest two main reasons for the location of this port in a sparsely populated area outside the major sea transit routes.

Point marking.

Suggested answers:

- The port will be used as a transport hub between East Asia, Europe and eastern North America via the **route through the Arctic Ocean**.
- It will serve as a **transshipment port** to reload goods from ships with icebreaking capabilities (used in the Arctic Ocean) to other ships.
- The port will support the **extraction of raw materials** from mines in the Arctic region, their processing and export to North America and Europe.

Award **1 mark** for each fully explained reason.

Award **0.5 marks** for each proposed reason without an explanation.

Award a maximum of 2 listed reasons.

Accept any other relevant and correct answer.

2 m

4. The investment in the Finnafjord Port Project would not have been possible a few decades ago. Specify **two changes** in global economic or environmental conditions that make the investment possible now.

Point marking.

Suggested answers:

- Climate change has **reduced the year-round ice cover** of the Arctic Ocean, making it navigable for specialised vessels.
- The **economic development of China** and other East Asian countries has increased the need for a shorter transport link between East Asia, Europe and eastern North America.
- Increasing awareness of greenhouse gas emissions and the growing popularity of **renewable energy sources**, with geothermal energy to be used in this project.

Each answer should specify a change in global economic or environmental conditions and give a short explanation.

Award **1 mark** for each specified change accompanied with an explanation.

Award **0.5 marks** for each specified change given without an adequate explanation.

Do not award general answers without specific reference to the proposed area/project (e.g. climate change, economic development of Europe/East Asia, greenhouse gases...)

Do not award responses that only refer to changes in local economic or environmental conditions.

Accept any other relevant and correct answer.

4 m

5. Outline the **environmental impacts** of the Finnafjord Port Project. Use at least two positive and two negative environmental impacts.

Point marking.

Suggested answers:

Positive environmental impacts:

- The shorter route between East Asia and the North Atlantic will reduce greenhouse gas emissions from maritime transport.
- Possible production and export of hydrogen using local renewable energy resources (geothermal, hydro, wind).
- Reduced greenhouse gas emissions from port activities as operations are powered by geothermal energy.

Negative environmental impacts:

- Infrastructure development will alter the landscape of Iceland's pristine northeast.
- Increased use of the trans-Arctic route will lead to increased pollution of the Arctic Ocean.
- Increased air pollution in NE Iceland and the North Atlantic Ocean.
- Facilitated extraction of raw materials from mines in the Arctic Ocean region.
- Facilitated extraction of minerals from the Arctic Ocean seabed.

A complete answer should contain at least two positive and two negative environmental impacts.

Award **1 mark** for each outlined answer.

Award a maximum of **2 marks** for positive environmental impacts and a maximum of **2 marks** for negative environmental impacts.

Do not award 0.5 marks.

Accept any other relevant and complete answer.

Section C: Land use and land cover change in Burkina Faso

Resource Booklet Figure C1 shows land cover change in Burkina Faso in 1975, 2000 and 2013.

2 m

1. Study Resource Booklet Figure C1.

The northern part of Burkina Faso lies in a large region that stretches across Africa from east to west.

a) Name this region.

Point marking.

Correct answer:

- Sahel

Award **1 mark** for a correct answer.

b) Identify the main **natural characteristic** of this region that explains the type of land cover in northern Burkina Faso.

Point marking.

Suggested answer:

- Low rainfall
- Semi-arid climate
- Steppe climate

Award **1 mark** for a correct physical characteristic related to climate.

Accept any other relevant and complete answer.

6 m

2. Study Resource Booklet Figure C1.

Describe in detail **three changing patterns** in land cover in Burkina Faso between 1975 and 2013.

Point marking.

Suggested answers:

- In the southern two-thirds of Burkina Faso, agriculture replaced much of the savanna between 1975 and 2013 (agricultural expansion).
- There was little change to the steppe vegetation in the northern part of the country.
- The area covered by settlements increased, with the main cities, Ouagadougou and Bobo Dioulasso, expanding into surrounding agricultural land.
- In 1975 most of Burkina Faso still had natural land cover (savanna, steppe, some forest, etc), but by 2013 much of this had been replaced by human-altered biomes (anthromes, anthropogenic biomes). (If anyone tries to estimate, it's 82.5% reduced to 57.4% natural land cover, but not expecting this accuracy.)
- Isolated pockets of savanna remained intact, mostly adjacent to the country's southern border.

- Gallery and riparian forests, widely dispersed in the southern part of the country, were reduced in area, converted to agricultural land.
- The water land use increased throughout the time period due to agricultural activation.

Award **2 marks** for each fully described pattern that contains the following elements:

- Describe what it has changed from.
- Describe what it has changed to.
- Include location/area in their answers (e.g. north/south, areal extent).
- Make good use of geographical terms in their answers (in addition to those in the key).

Award **0.5 marks** for each of the items listed above.

Award a maximum of three patterns.

Accept any other relevant and complete answer.

1 m 3. Specify the main **reason** for the land cover change in Burkina Faso.

Point marking.

Suggested answers:

- Population growth under the conditions that a large part of the population still works in agriculture.
- High natural population growth while most people still depend on (underdeveloped) agriculture.

Award **1 mark** for an answer that contains both following elements:

- Population growth or high natural increase
- Large share of the population still depends upon (underdeveloped) agriculture

Award **0.5 marks** for an answer that contains only one of the points listed above.

Accept any other relevant and complete answer.

3 m 4. Outline three **implications** of the land cover change for the ecosystems in Burkina Faso.

Point marking.

Suggested answers:

- Loss of habitat as many formerly natural areas are converted to agricultural land or built on.
- Reduced biodiversity, as many habitats with autochthonous plants and animals have to give way to agriculture or settlements.
- Some plants and animals are likely to become endangered species and may become locally extinct.
- Habitat fragmentation degrades the viability of plant and animal species.
- Few natural corridors connecting remnants of original vegetation threaten the long-term future/genetic diversity of plants and animals.

Award **1 mark** for each fully listed implication with a short explanation.

Award **0,5 marks** for each implication listed without an explanation

Award a maximum of 3 implications.

Accept any other relevant and complete answer.

5. In 2020, more than 50% of Burkina Faso's population suffered from chronic food deficiency. Suggest and explain three **sustainable development projects** that would help reduce food insecurity.

Point marking.

Suggested answers:

- Increase agricultural productivity by growing crops that can withstand harsh natural conditions and/or by using mechanisation in agriculture.
- Reduce post-harvest losses by building food storage facilities.
- Enable farmers to access credit to invest in mechanisation and increase agricultural productivity.
- Improve climate resilience of crops by using seeds adapted to natural conditions or by improving infrastructure for agriculture (e.g. irrigation systems).
- Improve food processing to preserve nutritional value.

Award **1 mark** for each explained project.

Award **0.5 marks** for each suggested project without an explanation.

Award a maximum of 3 projects.

Accept any other relevant and complete answer.

Section D: Innovative and sustainable cities

Innovative and sustainable cities refer to urban areas that incorporate innovative solutions and sustainable practices to enhance the overall quality of life for residents while minimising environmental impact. These cities prioritise the efficient use of resources, integration of technology, and the promotion of social, economic, and environmental well-being.

To achieve innovative and sustainable urban cities, key strategies include sustainable urban transportation and water-sensitive urban design. Sustainable transportation in cities focuses on public transportation networks, active transportation, electric vehicles, and integrated land use planning. Water-sensitive urban design involves incorporating green infrastructure, reusing water, creating wetlands, and mitigating the urban heat island effect.

Resource Booklet Figure D1 shows actual and forecast number of electric buses in urban transport in Europe 2018-2025.

Resource Booklet Figure D2 shows a model of design of a water-sensitive urban city.

2 m

1. Study Resource Booklet Figure D1.

Describe **two changes** in the number and structure of electric vehicles in the transport in the world between 2012 and 2021 using **specific evidence**.

Point marking.

Suggested answers:

- In general, the total number of electric vehicles in the world has increased from almost 0 to more than 16 million in 2021.
- The number of electric vehicles is growing rapidly (exponential increase) - there were 10 million electric vehicles in 2020 and 16 million in 2021, an increase of 60% in just one year.
- China is now the world leader in electric vehicles - around 50% of all electric vehicles are registered in China.
- China, Europe and the USA account for more than 90% of all electric vehicles in the world.
- Battery electric vehicles have a larger share than plug-in hybrids - about 75% in China, about a third in the US, while in Europe these two types have the same share.

Award **1 mark** for each described changed with a specific statistical evidence.

Award **0,5 marks** for each described changed without a specific statistical evidence.

Award a maximum of 2 changes.

Accept any other relevant and complete answer.

2 m

2. Study Resource Booklet Figure D1.

Suggest **two reasons** for changes in the use of electric vehicles in transport between 2012 and 2021.

Point marking.

Suggested answers:

- One of the main reasons for the increase in electric vehicles in operation is due to growing environmental concerns and the need to set more ambitious emission reduction goals (**0.5 marks**). Electric vehicles offer a cleaner and more sustainable alternative to traditional vehicles, as they produce zero tailpipe emissions when operating (**0.5 marks**).
- Another reason is the increase in government support and incentives as the governments have been actively promoting the adoption of electric vehicles through various support mechanisms and incentives such as financial subsidies, tax incentives and grants (**0.5 marks**). This will help to reduce upfront costs and make electric vehicles more economically viable for transport (**0.5 marks**).

Award **1 mark** for each fully explained reason.

Award **0,5 marks** for each reason listed without explanation.

Award a maximum of 2 reasons.

Accept any other relevant and complete answer.

4 m

3. Discuss the **benefits** and **limitations** of electric vehicle deployment. Your answer should include at least two benefits and two limitations.

Point marking.

Suggested answer (see table):

Benefits	Limitations
<p>Reduction of GHG emissions</p> <ul style="list-style-type: none"> • Electric vehicles produce zero tailpipe emissions, as they are powered by electricity instead of fossil fuels. This results in a substantial reduction in greenhouse gas emissions, such as carbon dioxide (CO₂), nitrogen oxides (NO_x), and particulate matter. • By transitioning from conventional diesel or gasoline vehicles to electric vehicles, cities and transportation systems can make significant progress in mitigating climate change and improving air quality. 	<p>Cost (including battery costs)</p> <ul style="list-style-type: none"> • Electric vehicles typically have higher upfront costs compared to conventional buses. • The cost of battery packs, charging infrastructure, and other components contribute to the initial investment required for deploying electric vehicles.

<p>Health benefits (improved air quality, minimization of noise pollution)</p> <ul style="list-style-type: none"> • Electric vehicles do not emit harmful pollutants into the atmosphere, leading to improved air quality. This has a direct positive impact on public health by reducing respiratory problems, asthma, and other health issues associated with poor air quality. • Electric vehicles operate much quieter compared to their diesel or gasoline counterparts. The absence of a noisy combustion engine contributes to a more peaceful and pleasant urban environment, especially in densely populated areas and along busy routes. 	<p>Infrastructure (charging locations, network modification) - limits route flexibility (depends on the battery type)</p> <ul style="list-style-type: none"> • Setting up an adequate charging infrastructure for electric vehicles can be a challenge. Charging stations need to be strategically located and require substantial electrical capacity, especially when multiple buses are charging simultaneously. Expanding the charging network can involve significant costs and infrastructure upgrades.
<p>Increased energy security (and potential for grid balancing)</p> <ul style="list-style-type: none"> • Electric vehicles rely on electricity as their primary fuel source, which can be generated from various energy sources such as renewable energy and conventional sources. By shifting from fossil fuel-dependent vehicles to electric vehicles, there is a reduction in reliance on imported oil and a diversification of energy sources. • This diversification contributes to greater energy security by reducing the vulnerability to supply disruptions and price fluctuations in the global oil market. 	<p>Consumer education and awareness (including transit operators/agencies)</p> <ul style="list-style-type: none"> • Electric vehicles are a relatively new technology, and many consumers may not be familiar with their operation, benefits, or charging infrastructure. • There is a need for consumer education to familiarize people with the concept of electric vehicles, their environmental advantages, and how they function differently from conventional vehicles. This lack of familiarity can result in skepticism, resistance to change, and reluctance to adopt electric vehicles.

Award **1 mark** for each fully explained benefit or limitation.

Award **0,5 marks** for each benefit or limitation listed without explanation.

Award a maximum of 2 benefits and a maximum of 2 limitations.

Accept any other relevant and complete answer.

3 m

4. Study Resource Booklet Figure D2.

Explain three **ways** in which the management of the flow of water influences the viability of a city.

Point marking.

Suggested answers:

- It prevents pluvial floods. Cities are often very vulnerable to pluvial flooding as they have many impermeable features that inhibit infiltration and thus intensifies the volume of overland flows. This can prevent the destruction of infrastructure and disruptions to the way of life in the city, thus improving its stability and liveability.
- It enables cities to better manage the inputs of water into them and to prevent water crises. For instance, separating wastewater and freshwater stores within the city can allow for potentially greater volumes of clean water for the city to use for consumption.

This access to clean water can improve the quality of life and thus liveability of its inhabitants.

- Managing flows of water by creating waterways can increase the recreational use of water in the city. This enhances the quality of life of its inhabitants as they are able to engage in a variety of recreational activities such as fishing or water sports.

Award **1 mark** for each fully explained way.

Award **0,5 marks** for each way listed without explanation.

Award a maximum of 3 ways.

Accept any other relevant and complete answer.

4 m

5. Study Resource Booklet Figure D2.

Evaluate the feasibility of implementing strategies to create a water sensitive city when planning or redeveloping urban areas.

Level marking.

Exemplary answers (arguments):

- Developing cities may lack the resources needed to implement and maintain these strategies, making it unfeasible. For instance, building green roofs come with high initial costs as well as incurring maintenance costs in the form of irrigation which just may not be present in these cities.
- Developing cities may struggle to find ways to integrate these water sensitive strategies into their urban landscape due to the presence of informal settlements. For example, trying to implement permeable pavements when most of the land area of a city is already settled and informally utilised is very difficult.
- Developing cities may be more immediately concerned with economic development and other aspects more crucial to the city's survival and may not consider aspects such as water management to be a priority. This may inhibit their ability to implement a complicated city design that is water sensitive.
- Developing cities are prone to be run by political entities who are apathetic to such concerns of urban planning. This inhibits the likelihood that they will take up such intricate plans to design a water sensitive city.

Award **4 marks** for a strong evaluation that includes at least two elaborated arguments.

Award **3 marks** for a good evaluation that includes at least two elaborated arguments.

Award **2 marks** for a satisfactorily evaluation that includes at least one elaborated argument or two listed arguments without elaboration.

Award **1 mark** for a poor evaluation that includes one partially listed argument.

Do not award 0.5 marks.

Accept any other relevant and complete answer.

Section E: Shorelines

Resource Booklet Figure E1 shows the Big Sur River mouth and adjacent beaches before and after the 2016–2017 fire–flood events.

Resource Booklet Figure E2 shows the Big Sur River watershed, including the boundaries of the 2016 Soberanes wildfire.

Resource Booklet Figure E3 represents an oblique aerial photo of the Big Sur River mouth and shows a coastal feature.

2 m

1. Study Resource Booklet Figure E1.

Note how the shoreline changes over time. Name four **factors** that influence geomorphological changes in shorelines.

Point marking.

Suggested answers:

- Sediment supply/discharge
- Precipitation rate
- Littoral drift
- Sea-level changes
- River flow
- Wave direction
- Wave energy flux (related to storm)

Award **0.5 marks** for each geomorphological factor.

Accept any other relevant and complete answer.

3 m

2. Study Resource Booklet Figures E1 and E2.

Explain how wildfires can affect the **width** of the sandy beach near the Big Sur River mouth.

Point marking.

Suggested answer:

- Fires burn vegetation/forests thus loosing anchors for the soil.
- There is an increased likelihood of soil erosion during subsequent rainfall.
- The increasing erosion rate increases sediment transport to and through rivers.
- The elevated fluvial sediment discharge expands beach widths and resupplies the littoral cell with sand.

Award **1 mark** for each of each element explained above.

Award **0.5 marks** for each element listed without providing an explanation.

Accept any other relevant and complete answer.

3 m

3. Study Resource Booklet Figure E1.

Geologists, engineers, and planners often need to know the rate at which the shoreline moves. This helps them to better define appropriate uses of coastal areas. Use the historical imagery provided to answer the questions 3a and 3b. The scale is the same for both images.

a) Is the beach at point '300 m' eroding or accreting over time?

Point marking.

Suggested answer:

- Accreting (no explanation is needed)

Award **0.5 marks** for a correct answer.

b) Estimate the **rate of change** of the shoreline at the point '300 m' to justify your response in part a. Your answer should include the full calculation. The rate must be expressed in metres per month.

Point marking.

Suggested answer – at point 300 m:

- The difference in beach width between the 2 shorelines = 80 – 100 m
- Time difference = 8 months

$$\text{Rate} = \frac{\text{width difference between the 2 shorelines}}{\text{time difference}}$$

$$\text{Rate} = \frac{80 \text{ m}}{8 \text{ months}} = 10 \text{ meters/month (minimum value)}$$

$$\text{Rate} = \frac{100 \text{ m}}{8 \text{ months}} = 12.5 \text{ meters/month (maximum value)}$$

Award **2.5 marks** for the calculation – **0.5 marks** for each of the following elements:

- **0.5 marks** for showing the difference in beach: any value in the range 80-100 m
- **0.5 marks** for showing time difference: 8 months
- **0.5 marks** for showing the formula for calculation
- **0.5 marks** for the result: any value in the range 10-12.5 m
- **0.5 marks** for expressing the result in metres per month

Accept any other relevant and complete answer.

1 m

4. Study Resource Booklet Figure E3.

Name the **coastal feature** identified as 'X'.

Point marking.

Suggested answer:

- Sea stack or sea stump

Award **1 mark** for a correct answer.

Accept any other relevant and complete answer.

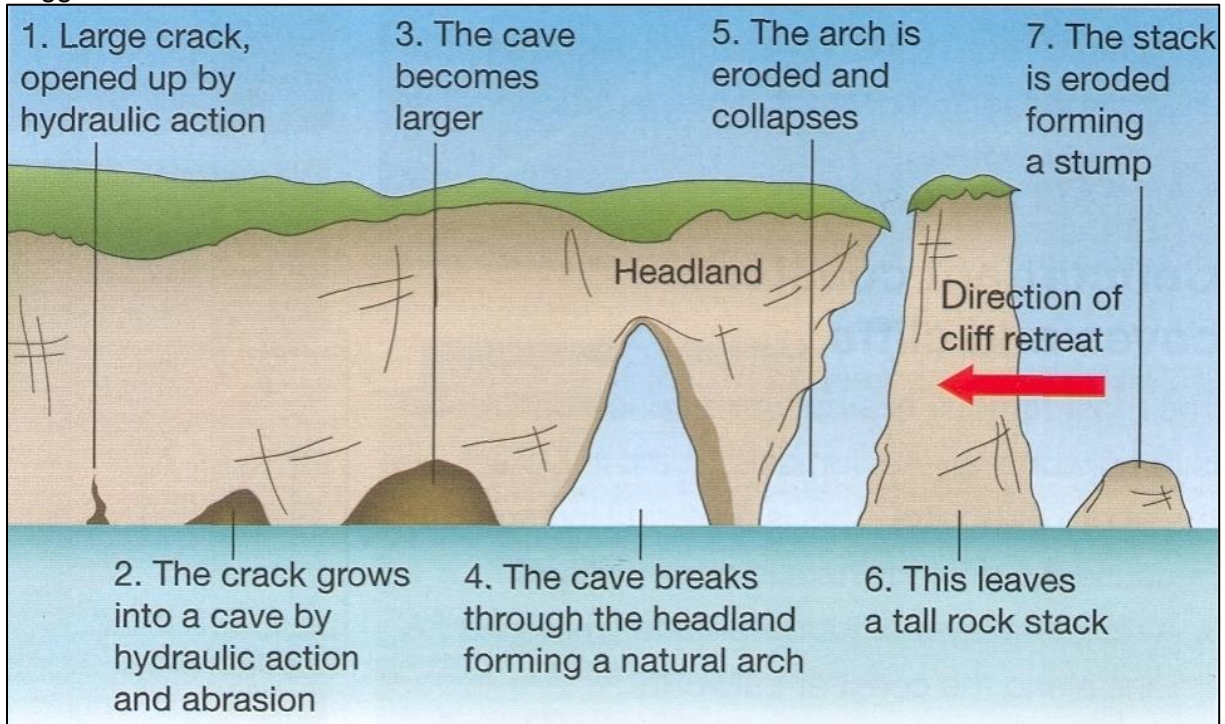
5. Study Resource Booklet Figure E3.

Use the information provided and your geographical understanding to answer the questions 5a and 5b.

a) Draw a **sketch** of the geomorphological processes that formed the coastal feature "X".

Point marking.

Suggested answer:



(<http://thebritishgeographer.weebly.com/coasts-of-erosion-and-coasts-of-deposition.html>)

The sketch needs to include the following:

- Drawing is in correct order of formation of a sea stack/sea stump.
- Evidence of a headland being eroded by the hydraulic action and abrasion from waves.
- Evidence of a cave, then arch being formed.
- Evidence of the arch collapsing and leaving a sea stack which will continue to erode into a sea stump.

Award **3 marks** for the sketch – **0.5 marks** for each of the following key elements drawn on the sketch:

- correct order of formation or direction of cliff retreat
- eroded headland
- hydraulic action and/or abrasion
- cave
- arch
- collapsed arch
- sea stack
- sea stump

Accept any other relevant and complete answer.

b) Explain the geomorphological process of the formation of the coastal feature "X" shown in the sketch.

Point marking.

Suggested answer:

- Hydraulic action is the predominant process.
- Weathering and erosion can create caves, arches, stacks and stumps along a headland.
- Caves occur when waves force their way into cracks in the cliff face. The water contains sand and other materials that grind away at the rock until the cracks become a cave.
- If the cave is formed in a headland, it may eventually break through to the other side, forming an arch.
- The arch will gradually become bigger until it can no longer support the top of the arch. When the arch collapses, it leaves the headland on one side and a stack (a tall column of rock) on the other.
- The stack will be attacked at the base in the same way that a wave-cut notch is formed. This weakens the structure, and it will eventually collapse to form a stump.

Award **3 marks** for the explanation – **0.5 marks** for each of the following steps of the formation of sea stump:

- **0.5 marks** for mention of hydraulic action or abrasion
- **0.5 marks** for explaining the formation of cracks
- **0.5 marks** for explaining the formation of caves
- **0.5 marks** for explaining the formation of arches
- **0.5 marks** for explaining the formation of sea stack (arch collapse)
- **0.5 marks** for explaining the formation of sea stump

Accept any other relevant and complete answer.

Section F: Ski tourism

Resource Booklet Figure F1 shows mountain ranges in the world with developed ski tourism.

Resource Booklet Figure F2 shows average annual skier visits 2010-2014 (in million).

Resource Booklet Figure F3 shows influence of innovation in transport on mountain tourism growth.

Resource Booklet Figure F4 shows examples of spatial transformation associated with ski tourism.

4 m

1. Study Resource Booklet Figures F1 and F2.

There are many spectacular mountain ranges in the world, but only a few have developed mass ski tourism. Outline and give reasons for 4 social and/or infrastructural **conditions** that have led to the development of mass ski tourism in the mountains.

Point marking.

Suggested answers:

- Ski infrastructure - enables the use of natural conditions for ski tourism and compensates for natural disadvantages (e.g. low snow cover, lack of snow...) (e.g. mechanically groomed ski slopes, ski lifts, car parks, accessibility by high capacity public transport - cogwheel or mountain railways, funicular railways...)
- Tourist services - ski tourism requires developed social services and infrastructures to accommodate skiers and enable their stay in ski tourism destinations (hotels, villas, varied accommodation, mountain huts, restaurants, bars, ski schools, shops...)
- Short distance to tourism demand - location within regions with a large population and good transport infrastructure, allowing short journeys to ski destinations
- Transport accessibility - access to the mountains (by roads, motorways, railways and airports) and within the mountains themselves (roads, cogwheel or mountain railways)
- Strong skiing communities - skiing is mainly practised by people living near ski slopes (local demand) and requires strong skiing communities and regular practise
- High standard of living - as ski tourism is generally more expensive than other types of tourism, its development requires a critical mass of wealthier tourists (residents)
- Availability of investment - capital for investment in technical and technological infrastructure and for the establishment of first ski tourism destinations
- Winter Olympics - during the organisation of the Winter Olympics, a massive infrastructure is built (mechanically groomed ski slopes, ski lifts, hotels, roads) and the destination is established and promoted internationally, attracting ski tourists even after the event
- Promotion, advertisement funding, Fashion for being in SKI Resorts / Social Network Trending

Award **1 mark** for each analysed condition with an explanation.

Award **0.5 marks** for each mentioned condition without an explanation.

Award a maximum of four conditions.

Accept any other relevant and complete answer.

2 m

2. Study Resource Booklet Figures F1 and F2.

Name two main **areas** where ski tourism has developed (use the names of the regions from Figure F1 or similar, not the names of continents or countries). Justify your answer with **statistical data** available in the Resource Booklet.

Point marking.

Answers:

- Alps (in Europe) – 176 million ski visits
- Rocky Mountains or Cordillera (in North America) – 75 million ski visits

Award **1 mark** for each region with approximate number of ski visits (allow ± 5 million difference).

Award **0.5 marks** for each region without the number of ski visits.

Do award answers that refer to whole countries or individual countries.

3 m

3. Study Resource Booklet Figure F3.

Ski tourism in the world has stagnated since the 1980s. Discuss changes in **tourists' travel behaviour** that could be responsible for this stagnation. Your answer should include at least three arguments.

Point marking.

Suggested answers:

- Falling airfares - tourists from developed countries can afford to travel overseas for the price of a winter holiday in the nearby mountains
- Changing the concept of winter holidays in the main tourism markets (Europe, USA) - instead of the mountains, they spend their winter holidays on the coast of the southern hemisphere
- Replacing ski tourism with less expensive and less physically demanding forms of tourism - coastal tourism on the Mediterranean and overseas
- Multiple holidays - trend towards more short holidays spread over the year instead of taking one long summer and winter holiday (e.g. city breaks, cultural tourism...)
- Increased environmental awareness - tourists are increasingly opting for new, unspoilt destinations with intact nature instead of spending their holidays in overcrowded, polluted and densely populated mountain areas
- Declining popularity of ski tourism - partly a result of recent immigration of people who are not interested in or used to skiing (decline of ski communities)
- Ageing of the population - men tend to ski until retirement and women until the age of 60 and then replace ski tourism with less physically demanding tourism activities (e.g. cultural tourism, hiking...)
- The influence of climate change, the skiing season is shortened (snow falls later, melts earlier) - as a result, the length of the ski resort visit period decreases, fewer tourists can be accommodated
- Rising prices of ski tourism (Ski lifts prices / Day pass etc) = Stay becomes more expensive comparing with others tourism directions

Award **3 marks** for a discussion that contains at least three explained arguments.

Award **1 mark** for each explained argument.

Award **0.5 marks** for each partially explained argument.

Do not award general answers that do not contain specific information (e.g. demographic changes, increasing air traffic...).

Accept any other relevant and complete answer.

3 m

4. Study Resource Booklet Figure F4a.

Name the **phenomenon** that can be seen in the photograph. Explain how ski tourism can increase the **hazard** of this phenomenon.

Point marking.

Suggested answers:

Phenomenon on the photo:

- Avalanche

Explanation:

- Avalanches usually occur on slopes steeper than 30° and mostly outside ski areas (as ski areas are mainly built on less steep slopes and tend to control avalanches).
- A greater danger comes from off-piste skiing in untouched nature (mostly by experienced skiers).
- When a person skiers or snowboards over a particularly weak area, this bit of extra weight and movement can set off a disaster. Any particular layer of snow can only bear so much weight and once that amount is exceeded, it becomes liable for a sudden collapse.

Award **1 mark** for the name of the phenomenon.

Award **2 marks** for a full explanation that contains at least **four** of the following elements:

- Slopes steeper than 30°
- Higher hazard outside ski areas
- Off-piste skiing (or outside ski runs)
- Skiing over a weak area of snow
- Putting extra weight
- Triggering a collapse
- Award 0.5 for each key element

Award **1 mark** for an explanation that contains at least two of above-mentioned elements. Do not award any marks for an explanation that does not mention skiing outside ski resorts (or ski slopes).

Accept any other relevant and complete answer.

3 m

5. Study Resource Booklet Figure F4.

Using the information provided and your geographical understanding explain three **negative environmental impacts** of ski tourism in the mountains.

Point marking.

Suggested answers:

- Deforestation - large areas of natural mountain forests are cleared to make way for ski slopes, ski lifts, tourist accommodation and other services or infrastructure.
- Damage to fragile natural vegetation - particularly affected by off-piste skiing and snowmobiling in pristine natural areas (this can also scare away wildlife)

- Erosion - the construction of ski slopes can leave permanent marks on the landscape, and in the warm season they often lack vegetation, making them vulnerable to erosion during heavy rainfall or snowmelt
- Alteration of the drainage network - snowmaking facilities (or snow guns) require significant amounts of water from mountain streams, which are therefore often diverted and do not carry (enough) water in the lower lying parts where it is needed for natural vegetation or other human needs (e.g. agriculture, water supply...)
- Increased risk of avalanches - skiing off-piste can trigger the collapse of a large amount of snow that is at the threshold of its own mass on mountain slopes
- Increased risk of landslides - construction for tourism purposes can result in the removal of natural vegetation or the cutting of slopes, which in the case of clay soils can result in the loss of slope stability and trigger a landslide (or even a mudslide in the case of heavy rainfall or snowmelt)
- Change in land use - land that was previously used for agriculture, pasture or forest is converted into dams for artificial lakes, hotels, ski lifts or residential growth.
- Increased amount of waste - more space users produce a greater amount of solid and liquid waste that needs to be treated and landfilled, often in mountainous areas. In addition, a higher concentration of food waste can lead to more predators (e.g. bears, wild boars) near human settlements.
- Air pollution - the mountain air, which is actually clean, is often polluted by exhaust fumes from road traffic (cars) when the public transport system is underdeveloped, or by chemicals used in snow production.
- Noise pollution - a consequence of increasing traffic (especially private transport) and snow cannons on the ski slopes.
- Urban sprawl - uncontrolled growth of human settlements in mountain areas due to the construction of new accommodation for tourists (hotels, villas...), for seasonal workers or the local population.

Award **1 mark** for each listed impact accompanied by an explanation.

Award **0.5 marks** for each listed impact without an explanation.

Award a maximum of three identified impacts.

Do not award general answers that fail to provide specific information (e.g. pollution, waste, damage to nature etc.).

Accept any other relevant and complete answer.

Notes

end ■