



# **14<sup>th</sup> International Geography Olympiad**

Belgrade, Serbia

2–8 August 2017

## **WRITTEN RESPONSE TEST**

### **Marking Scheme**

## Instructions for Markers

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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, one of the designated Moderators – Dubravka or Anu.
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 Moderators (Dubravka and Anu) will sample the marking of all teams.

## Command Terms for use in Written Response Test

Terms	Meaning
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
Explain	give a reason, a cause, an effect, a consequence for why or how something happens
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
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
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.

### Written Response Test

Contributions from: Australia, Germany, Indonesia, Japan, Mongolia, New Zealand, Switzerland, Taiwan/China–Taipei and UK

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## Section A: Geography of Sport

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2 m

1. After the 1992 Rio de Janeiro's Earth Summit 'a responsible concern for environmental issues' was added to the Olympic Charter.  
Identify 4 ways that sporting mega-events can promote environmental **sustainability**.

Answer (point marking – 0.5 marks for each correct way):

- Private parking banned at Olympic venues and spectators receive free travel on trains and Olympic buses, encouragement of bicycle transport system.
- Providing drinkable tap water instead of bottled water.
- Sorting and recycling or composting garbage at sporting mega-event sites.
- Using recycled products, e.g. recycled paper in its administration and advertising.
- Rainwater can be collected and used for flushing toilets.
- Expand green areas in and around sporting mega-event venues (forestation) in order to improve air quality.
- Native trees and shrubs planted around venues to reduce water and mulching needs and encourage wildlife.
- The roofs of Olympic venues and Athletes Village can be equipped with solar panels constituting the equivalent of a small power station.
- If the area where the sporting mega-event venue is located is predominantly windy, wind can also be used as an energy source.
- The energy recycled from the ice rinks air conditioning unit can heat the showers and the bathrooms at the venue (when this system uses ammonia, it does not destroy the ozone layer).
- Using eco-friendly and energy-saving building materials at the sporting mega-event venues (bamboo; reclaimed lumber; recycled metal – iron, aluminium, copper; recycled plastic).
- Develop present (built-up) sites instead of new venues
- Venues with pleasant climate – no need for air-condition
- Recycled building materials
- Commercials during broadcasting can advertise sustainability (techniques, materials)
- Sponsorships of eco products (solar panels etc.)
- Selective waste collection
- Using local materials for construction
- Protected areas should not be touched by investors (forests, water)
- Reduce transport (CO<sub>2</sub> emission) by reducing distances between sites
- Side events promoting environmental protection
- Famous sportsmen can promote sustainability
- Use daylight instead of light bulbs

2. Study Resource Booklet Figure A1: Location of Olympic zones for Summer Olympics in 2016 in Rio de Janeiro.

With the help of the information provided suggest 3 challenges faced in developing the Olympic zones in Rio de Janeiro.

Answer (point marking – 1 mark for each correct challenge, half marks were accepted):

- Three (Barra, Copacabana and Maracanã) out of four Olympic zones were planned in **favela** areas, so these had to be cleared by relocating their inhabitants whose income is very low. Evicting people even on fair compensation always causes resistance as abandoning home is always challenging. The raised level of awareness around the world for precariat can also initiate boycotts as favelas are often hidden from view by embarrassed government.
- Favela areas witness **high violence and crime rate** causing extra costly safety measures for protecting the international athletes and audience. Furthermore the image or perceived lack of security may hindrance attendance or causing traffic jams to avoid night time walking, increasing the chance to be assaulted in vehicle scams.
- High development costs of insufficient and/or poor existing **infrastructure** as for example the airport is located on a separate island connected with two roads to the mainland. Olympic zones of Deodoro and Barra are lacking local roads also due to hilly and forested terrain making it also difficult using underground solutions (metro, tunnel). Large distances between Olympic zones require better, diverse and faster traffic infrastructure.
- Possible development nature protection and heritage **restrictions** due to hilly terrain preventing building and infrastructure activities and underground solutions (metro, tunnel). Forested and green areas might also be protected, which is a challenge to building an extensive road network or Olympic infrastructure. Copacabana Olympic zone was already famous tourist site before with its *balneario* (resort town) beach, which is one of the most famous in the world, including iconic Botafogo Bay with Sugarloaf Mountain (Pão de Açúcar), the Christ Redeemer Statue, famous Ipanema *bairro* (neighbourhood) beach and Rodrigo de Freitas Lagoon (Lagoa Rodrigo de Freitas) with ongoing decontamination process to accommodate new developments.
- Relocation of slums - loss of informal economy – incomes and services
- Big distances between the sites – need for massive infrastructural investment
- Relief (terrain topography) – cost of infrastructure
- Space conflict
- Sea, humidity, climate – difficulties in construction
- Clean up polluted area (favelas; seashore)
- Congestions: densely built up + new development
- Water, waterfront locations – environmental concerns

4 m

3. Olympic Games are followed by the Paralympic Games – a major international multi-sport event involving athletes with a range of disabilities.

Outline 2 changes the **Paralympic** Games have brought about in society.

Answer (level marking – 2 marks for each well elaborated change and 1 mark for poorly elaborated change):

- The practice of sport is a human right. Recent games have emphasized that these games are about ability and not disability. Therefore witnessing paralympic athletes (especially in totalitarian regimes) is really a transformation tool for changing societal attitudes towards people with disability reducing discrimination. Acknowledging Paralympians' achievements on the same level as Olympians on state level and selecting the year's athlete competition supports it. Still broadcasting of the event is not very commonplace, thus scandalous participants like Oscar Pistorius who was able to compete both in London 2012 Olympic Games and several Paralympic Games and is a convicted murderer is attracting attention and raising awareness of how do we distinguish disability. Employers' willingness to hire people with disabilities has increased.
- Paralympic venues have been recently the same as Olympic Games stressing the importance of accessibility to buildings, sidewalks and public spaces for people with disability. The venues may be equipped with many devices intended to increase accessibility but are not actually designed with disabled people's needs in mind: ramps might be too steep, entrances wide enough for wheelchair but lacking correctly positioned handrails in showers and toilets. Connectivity throughout the urban fabric to the venues may be lacking, for example the public transport may be even customized to wheelchair lifts (wide entrance) but these can be out of order or drivers might stop away from the curb while there are buses designed that can be lowered to ground level; crosswalks lack any audible signals for the visually impaired. Usually the legislations are up to date with United Nations and Paralympics and Olympics have been catalyst in enforcing small changes in urban landscape like smoothly paved roads, wide entrances, ramps and elevators for people limited in their mobility.

2 m

4. Study Resource Booklet Figure A2: Time series of sport-related costs for Olympics 1960–2016.

Describe 2 **main** trends in the cost of hosting the Olympic Games.

Answer (point marking – 1 mark for each correct trend):

- The cost of organizing the Olympics has increased both for Summer and Winter Games.
- The Winter Games have been cheaper than Summer Games (except for all times most expensive games in Sochi 2014).
  - The expense of the Summer Olympics has varied more than Winter Olympics.
  - The cost of organizing the Winter Olympics has increased more significantly, especially after 2002 (except for Vancouver in 2010).
  - There are remarkable outliers exceeding vastly the average expenditure: Barcelona 1992, London in 2012 (both Summer Games) and Sochi 2014 (Winter Games).

5. Mark with an 'X' on the continuum below to show how far you agree or disagree with the following statement:

"The positive impacts of sporting mega-events often exceed the negative impacts".

Strongly agree

Strongly disagree

With the help of the information already provided justify your response.

Answer (level marking – 4 marks for excellently elaborated justification naming but refuting oppositions convincingly depending on agreement position, 3 marks for fully, 2 marks for satisfactorily and 1 mark for poorly elaborated justification depending on agreement position):

Strongly agree (sporting mega-events have **more positive** impact):

- Such projects can regenerate the whole economy and mostly bring a large number of short-term and long-term economic benefits to the hosting countries/cities. With the economic impetus many of the other issues can be solved.
- Urban regeneration of many city areas (landscape) – new facilities/infrastructure develop(s) on the site of old "shabby" ones that are in poor condition through long use or lack of care; increase of quality of life.
- Infrastructure of the country/city automatically cuts the costs for hosting another sporting mega-event in the future, even if next event's organization cost may exceed the previous one.
- Sporting mega-events are likely to provide new additional workplaces during the pre-event phase of the competition; due to the infrastructure development unemployment can be reduced to some extent.
- Sporting mega-events promote the hosting country/city and attract more tourists thus bring more money.
- Tourism boosts consumer expenditure and promotes an increase in retail trade, which is very beneficial for the hosting economy.
- Tourism promotes job creation, because a lot of hotels, markets, entertainment facilities like night clubs etc. are most likely to be created for the foreign visitors.
- Encourage people to take up sport which is good for their health, and the country's health expenditure.

Strongly disagree (sporting mega-events have **more negative** impact):

- Such projects can cause to the hosting countries/cities many financial problems before and after the event is finished degrading many relevant spheres of local life.
- Such events have the potential to have negative publicity due to corruption, cost overruns and causing irreversible damage to natural environments.
- New infrastructure (sport arenas etc.) and security of the participants can become a financial burden for the hosting country/city (such events require large amounts of money).
- Many newly developed facilities for the sporting mega-event can never be fully used again, and very soon they are abandoned and decay.
- Such projects could exacerbate socio-spatial segregation, inequality and social conflicts, sometimes affecting indigenous nations.
- Organizing such events may lead to the difficulties in the life of the low-income population as the government sometimes evicts or allocates poor residents in order to build new stadiums and roads needed for the sporting mega-event.
- During the sporting mega-events prices of groceries (food, drinks etc.) and public transportation can rise and that could directly affect the population expenditure, as it will considerably decrease.

- Some businesses can experience major inconveniences for their customers and staff, during the construction phase (access, noise) and when the event is being held (traffic, security) and their turnover/output can go down.

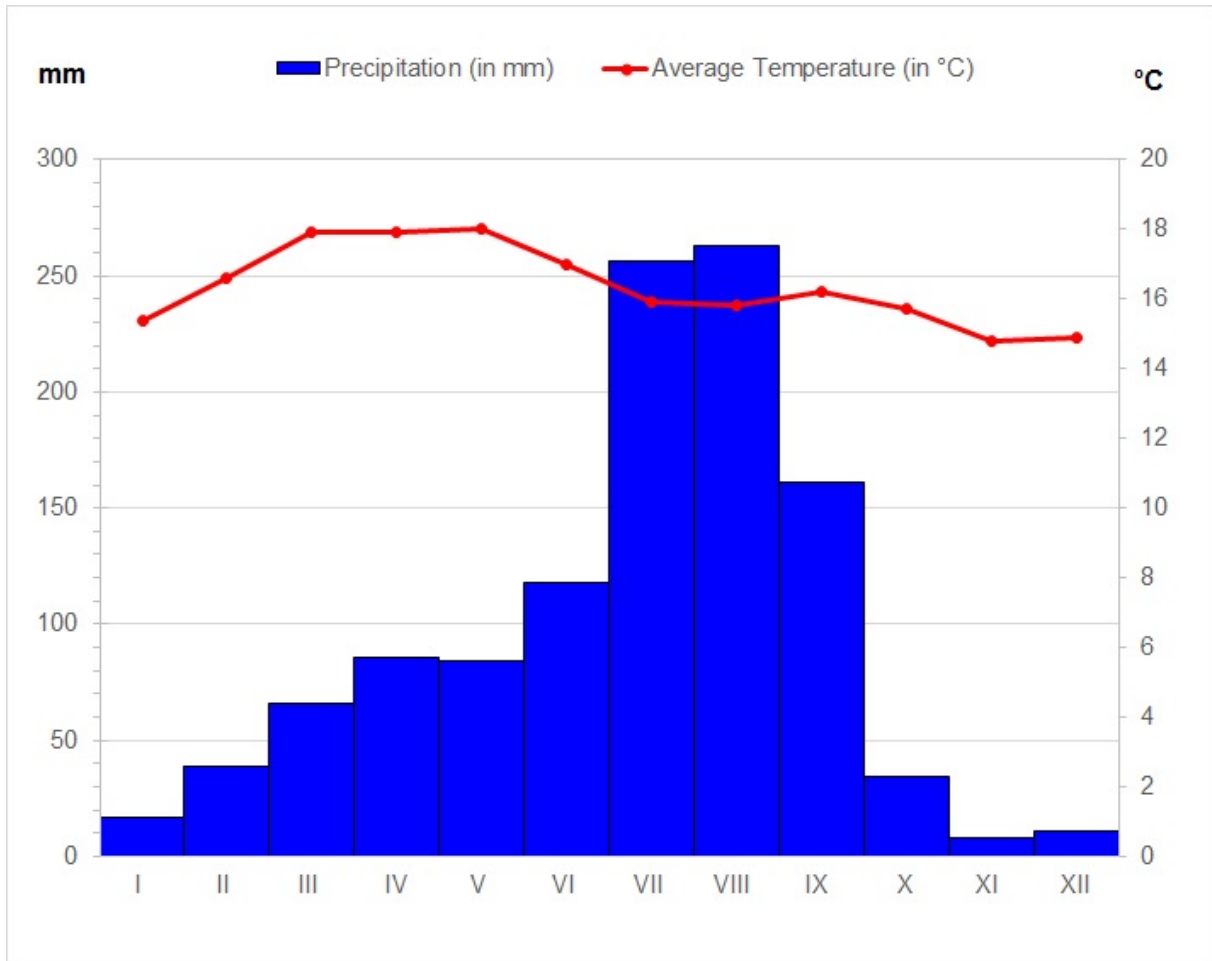
Between Strongly agree and Strongly disagree: a mixture of positive and negative statements with balancing actions and mitigation measures.



## Section B: Climate and Weather

- 4.5 m 1. Study Resource Booklet Table B1: The climate data for Addis Ababa, Ethiopia. Draw a climate graph based on the data from the Table B1.

Answer (point marking):



- Labelling X-axis (“January, February, March...” or “Jan, Feb, Mar...” or “J, F, M...” or “I, II, III...” or “1, 2, 3...”) (0.5 m).
- Labelling left Y-axis (“Precipitation in mm” or “mm” and numbers) (0.5 m).
- Labelling right Y-axis (“Average Temperature in °C” or “°C” and numbers) (0.5 m).
- Legend or key (0.5 m).
- Correctly drawn precipitation with columns (1 m).
- Correctly drawn temperature with line (1 m).
- Using blue colour for columns/precipitation and red for line/temperature (0.5 m).

2.5 m

2. Study Resource Booklet Table B1: The climate data for Addis Ababa, Ethiopia and your climate graph for Addis Ababa, Ethiopia above. Identify the wet (rainy) season and explain the main factors causing the rain in this season.

Answer (point marking – 0.5 marks for correct season and 2 marks for correct factors):

Wet season: summer period (June/July–September).

The rainy season is caused by:

- Southeast trade winds after crossing the Equator become southwest **monsoon winds** that brings moisture from Indian Ocean.
  - Inter-Tropical Convergence Zone (ITCZ) and the moist south-westerly monsoon flow from the Southern Hemisphere are the main rain producing structure.
  - The onset and spatial distribution of rainfall are also found to follow the oscillation of the ITCZ and the intensity of the southern hemispheric anticyclones.
  - Southerly/south-westerly cross-Equatorial moisture flow from the southern Indian Ocean and central tropical Africa.
- Warm and moist air mass is lifted over a mountain range of the Ethiopian Highlands, air cools, orographic clouds are formed and they serve as the main source of the large amount of precipitation (rain) in this area.
  - The formation of heat flows over the Sahara and Arabian landmasses.
  - Upper level Tropical Easterly Jet (TEJ) flowing over Ethiopia.
  - Low-level jet (Somali jet).

3 m

3. Study Resource Booklet Table B1: The climate data for Addis Ababa, Ethiopia and your climate graph for Addis Ababa, Ethiopia above. Suggest 3 reasons for the **monthly average temperature pattern** (over a year) in Addis Ababa, Ethiopia.

Answer (point marking – 1 mark for each correct reason):

- Location near Equator means that temperatures are very constant from month to month (little variation in temperature throughout the year).
- Elevation moderates temperatures year-round.
- Maximum of temperature occur during the equinox.
- Average monthly temperatures are lower than in other tropical areas due to higher elevation (highlands).
- The winds that get pushed up and form clouds which further lowers the temperatures during the day.
- The lowest average monthly temperatures are during wet (rainy) season because of increased cloudiness which decreases insolation.

2 m

4. Study Resource Booklet Figure B2: Surface pressure maps of 9–10 December 2014. Explain the **distribution** of air pressure in the Northern Atlantic and over the European continent on 9–10 December 2014.

Answer (point marking – 1 mark for explaining land and sea air pressure system difference, 1 mark for polar front and other influencing circumstances):

- During winter (December) on the Northern Hemisphere in northern Atlantic Ocean (between Greenland and Iceland) area of **low-pressure** (known as Icelandic Low) is formed due to the fact that **in winter the sea is cooling more slowly than the continent** and due to the warm Gulf Stream (higher temperatures).
- The low pressure system near Iceland exists because of the **polar front** – where mild mid-latitude and frigid polar air run into each other. As the two air masses meet, **air rises**.
- Over Europe in winter forms an area of **high air pressure** (known as Siberian High or Siberian Anticyclone) because **the continent is cooling much faster than the sea/ocean**.

3 m

5. Study Resource Booklet Figure B2: Surface pressure maps of 9–10 December 2014. Based on the observed movement of fronts, forecast the weather for 3 regions in Europe in the following 24 hours (11 December 2014).

Answer (point marking – 1 mark for each correct forecast):

- Over southwestern (Iberian peninsula) and southern (Mediterranean) Europe is high-pressure and these areas will have dry weather without any precipitation.
- Over western and central Europe occluded front will form and bring cloudy weather with precipitation.
- Northern Europe (Scandinavia) will have strong winds and heavy precipitation (snow) due to cyclone (Icelandic Low) coming from northern Atlantic.
- Southeastern and eastern Europe will have cloudy weather with some precipitation.

## Section C: Transportation and its Environmental Impact

3 m

1. Study Resource Booklet Figure C1: The dominant road networks, shipping lanes and airline routes around the world.

Describe the spatial pattern on a **global** scale of:

Answer (point marking – 1 mark for each correct pattern):

- Road networks:
  - Road networks are more close to large urban / densely populated areas.
  - Road networks are less dense in areas where there are deserts, tropical forests, topographic features such as mountain ranges.
- Shipping lanes:
  - Shipping lanes are mostly in the Northern Hemisphere and fewer in the Southern Hemisphere.
  - Shipping lanes are mostly between the continents of North America and Western Europe, East Asia and North America, East Asia and Europe (via the Suez Canal or the Cape of Good Hope).
  - Shipping routes generally “hug” coastlines (or are closer to coastlines).
  - There are numerous shipping lanes between the East Asian ports.
- Airline routes:
  - Airline routes are mostly in the Northern Hemisphere.
  - Airline routes are mostly between North America, Western Europe and East Asia.
  - There are numerous airline routes within East Asia.

4 m

2. Study Resource Booklet Figure C1: The dominant road networks, shipping lanes and airline routes around the world.

Suggest 4 reasons for the pattern of transport routes.

Answer (point marking – 1 mark for each correct reason):

- Road networks are not dense in mountainous or desert areas because of the low population density there, and the lack of factories that have goods to transport out. The terrain is unfavourable for living or for expanding industrial areas.
- Shipping lines “hug” coastlines whenever reasonable to avoid open sea harsh conditions and go along straight lines when the speed outweighs the risk.
- Shipping and airline routes are geographically concentrated because global major trading hubs and ports are in the Northern Hemisphere (North America, Western Europe and Eastern Asia).
- Multiple airline routes intersect or overlap and finish in areas with dense road networks because logistics or passenger movement continues from the port of call, into the hinterland.

3. Study Resource Booklet Figure C2: The rail network in South Africa and the 2 Tables below.

With the help of the information provided suggest 4 reasons for the **proportion** of freight (cargo) transport modes.

Table: The freight (cargo) transport in South Africa (2012).

Corridor	Road (Mtons)	Rail (Mtons)
Pretoria / Johannesburg – Durban	46.8	6.4
Pretoria / Johannesburg – Cape Town	34.2	1.7
Durban – Cape Town	9.0	< 0.1
Durban – East London	8.8	< 0.1
Pretoria / Johannesburg – Port Elizabeth	5.7	0.3
Other corridors	79.4	27.1
Metropolitan areas	124.1	5.8
Rural areas	255.0	39.0
<b>Total</b>	<b>563.1</b>	<b>80.3</b>

Adapted from [https://www.environment.gov.za/sites/default/files/docs/publications/freightshift\\_roadtorail.pdf](https://www.environment.gov.za/sites/default/files/docs/publications/freightshift_roadtorail.pdf)

Table: The annual costs of road and rail freight (cargo) transport in South Africa (2014).

	Road (Rand, billion)	Rail (Rand, billion)
Vehicle capital cost	25	2.0
Infrastructure capital cost	7.0	4.0
Vehicle operating cost	422	47
Infrastructure operating cost	2.0	

[https://www.environment.gov.za/sites/default/files/docs/publications/freightshift\\_roadtorail.pdf](https://www.environment.gov.za/sites/default/files/docs/publications/freightshift_roadtorail.pdf)

Answer (point marking – 1 mark for each correct reason):

Despite rail transport is cheaper to use road transport preferred.

- Generally less popular freight transport on rail because of very specific routes that do not serve every city or rural area.
- Least rail transport used between Durban and Cape Town, and Durban and East London because of no direct rail link.
- Due to the fact that rail networks are not equally distributed throughout South Africa, difficulty in reaching stations/hubs may lead to suppliers or manufacturers choosing the easier option of road transport, which gives them flexibility of time.
- Even when freight goes by rail, it generally has to be transported by road at the start and end of the shipment. This adds extra costs and also extra time.
- Freight transport in metropolitan areas is more dominated by road transport than rural areas because of the presence of more road networks in metropolitan areas, while rural areas might have to depend a little more on rail transport.
- It may be that metropolitan area freight is transported much shorter distances than rural freight, meaning that the transshipment costs and extra time make rail transport uneconomic within cities.
- Small scale suppliers in the rural areas may not be able to afford the expenses of road transport, thus depending more on rail transport than metropolitan areas.

#### 4. Discuss the environmental impact of building railways.

Answer (level marking – 4 marks for excellently elaborated discussion, 3 marks for fully, 2 marks for satisfactorily and 1 mark for poorly elaborated discussion):

- Vibration on ground and implications on lived environment for residents around the area.
- Tunnelling and implications on groundwater pollution if engineering works are not done properly.
- Noise pollution along the entire railway routes.
- Less carbon emissions in the long run if freight shifts from road to rail.
- Clearance of land for railroads leads to the destruction of habitats and interrupts movement of wildlife.
- Reduce congestion with fewer trucks if freight shifts from rail to road.

## Section D: Tides

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2 m

1. Identify 4 factors **causing** and/or **influencing** tides.

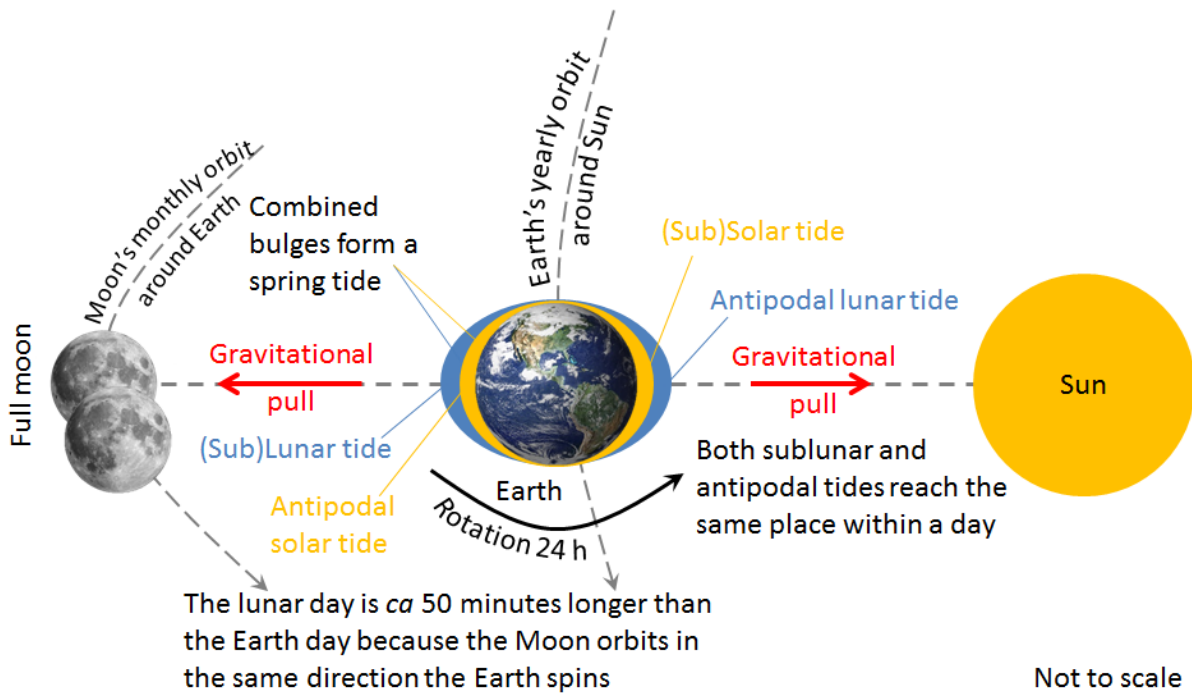
Answer (point marking – 0.5 marks for each correct factor):

Tidal constituents:

- Moon's gravitation,
- Sun's gravitation,
- Earth's rotation,
- Inertia (on the side of the Earth away from the Moon, inertia exceeds the gravitational force, and the water tries to keep going in a straight line, moving away from the Earth, also forming a bulge),
- The position of the Moon and Sun relative to the Earth,
- Moon's distance from the Earth (when the Moon is closest, at perigee, the tidal range increases, and when it is at apogee, the range shrinks),
- Earth's distance from the Sun (the elliptical shape of the Earth's orbit around the Sun),
- The obliquity (tilt) of the Earth's Equator and rotational axis,
- Lunar altitude (elevation) above or below the Earth's Equator: Moon's declination (angle from Earth's Equator ranging from 28°N to 28°S over the course of a month),
- The Moon's orbit inclination from the ecliptic (the plane of the Earth's orbit around the Sun): Moon's inclination is about 5°, and the direction gradually changes over an 19-year cycle, alternately adding to or subtracting from the 23.5° tilt of the Earth's axis,
- Sun's declination (ranging from 23°N to 23°S over the course of the year),
- Gravitational effects of other celestial bodies,
- The placement of landmasses on Earth,
- The amphidromic systems of the oceans,
- Bathymetry,
- The shape of the coastline,
- The shallow depth of water relative to wavelength of tides,
- Distance from the landmass: conversely, mid-oceanic islands not near continental margins typically experience very small tides of one meter or less,
- The latitudinal variation of the rotational velocity of Earth,
- The Coriolis Effect,
- Local wind and weather patterns (low and high pressure systems).

2. Draw an annotated diagram(s) to explain how **2 very high tides** occur **twice during a day (24 hours)** when there is a **full moon**.

Answer (point marking):



Adapted from: <http://www.canaturalist.com/2016/01/23/bogus-terminology>,  
<https://manoa.hawaii.edu/exploringourfluidearth/physical/tides/tide-formation-and-gravitational-pull>,  
<https://www.flickr.com/photos/donkeyhotey/5679642883>,  
<http://www.thehoodwitch.com/blog/2017/3/11/full-moon-in-virgo-3122017>.

- The Sun, Earth, and Moon form a line (a condition known as syzygy) and the Moon is in correct position (1 m).
- Solar and lunar tide bulges augment each other (coinciding) (called spring tide) (1 m).
- Subsolar tide and antipodal lunar tide and antipodal solar tide and sublunary tide are coinciding on opposite sides of the Earth (1 m).
- Earth's anticlockwise rotation duration and orbit (0.5 m) and the Moon's counter clockwise movement on its orbit (0.5 m).
- Annotations (explaining rotation durations and including labelling of Sun, Earth, full moon, (sub)solar tide, (sub)lunar tide and antipodal tides) (1 m).



3. Study Resource Booklet Figures D1–D3: Photos and satellite imagery of Mont Saint-Michel, France.

Read the textbox below.

With the help of the information provided, suggest 4 reasons **why massive landscape-changing projects were started** at Mont Saint-Michel in 2006.

Textbox

Mont Saint-Michel is a famous tourist destination in France, and is world heritage listed. It is an island located about 1 km off the country's north-western coast, at the mouth of the Couesnon River, which has been canalized. The area has a high tidal range, at approximately 14 m between high and low water marks. Mont Saint-Michel was previously connected to the mainland by a tidal causeway (a path uncovered only at low tide). This was converted into a raised, permanently dry, causeway in 1879. Coastal flats on the adjacent mainland have been reclaimed (made into polders) creating pastureland in addition to occasional flood-induced salt marsh meadows used for grazing.

In 2006 a €164 million project was announced to build a hydraulic dam using the waters of the Couesnon River. Another €209 million project included the removal of the causeway and visitor car park, replacing it with a new bridge.

Adapted from [https://en.wikipedia.org/wiki/Mont\\_Saint-Michel](https://en.wikipedia.org/wiki/Mont_Saint-Michel)

Answer (point marking – 1 mark for each correct suggestion):

- These radical measures were launched because the unique characteristics of Mont Saint-Michel were being heavily degraded and France has international responsibilities to maintain the character of world heritage listed sites: the insular character during high tide that attracted tourists was being lost due to accumulating silt deposits. Due to increased siltation/silt deposits the castle was no longer surrounded/cut off by the sea at high tide which attracted tourists:
  - The raised (permanently dry) causeway prevented the tide from scouring the silt around the mount. Replacement of the causeway with a bridge has restored the flow of water around the island.
  - Land reclamation on coastal flats (polders) and grazed salt marsh meadows decreased the distance between the shore and the island allowing less and not so deep free water movement having less force to clean the area from disposed sediments.
  - The canalized river reduced the spread of water (dispersion of the flow of water) to wash away accumulated silt from the (area). A hydraulic dam uses the waters of the river Couesnon and the tides to help remove the accumulated silt.

4. Study Resource Booklet Figure D4: Artistic impression of a future tidal lagoon power plant, where an artificial lagoon is created within seawalls.

Suggest one Strength, one Weakness, one Opportunity, and one Threat (SWOT analysis) for any new tidal power plants that could be constructed across the world, besides energy production.

Strength:	Weakness:
Opportunity:	Threat:

Answer (point marking – 1 mark for each correct suggestion):

<p><b>Strengths</b> – are internal characteristics of the project that give it an advantage over other projects</p> <ul style="list-style-type: none"> <li>• Unlike some other renewable sources of power, tidal power is predictable.</li> <li>• They can be constructed in areas where the coastal landforms mean that the old type of tidal power plant is not feasible.</li> <li>• In areas vulnerable to flooding and coastal erosion, increasingly as a result of climate change, tidal lagoons can act as a barrier to potentially damaging and disruptive storm surges and waves that threaten coastal communities and infrastructure.</li> <li>• Because it would be a landmark, it will be instrumental in instigating/initiating regeneration and other developments.</li> <li>• Renewable clean zero carbon (no CO<sub>2</sub> during operation) year round cheap energy.</li> <li>• Jobs in building and managing.</li> <li>• It does not take land space because it is built on the water (no waste of arable land).</li> </ul>	<p><b>Weaknesses</b> – are internal characteristics that are a disadvantage relative to other projects</p> <ul style="list-style-type: none"> <li>• It is only feasible in areas with a high tidal range.</li> <li>• Enormity of the project, high cost, procurement of right kind of building materials such as rocks, gravel and sand.</li> <li>• As a first of its kind, none of the real impacts on environment, economy and socio-cultural life is known.</li> <li>• The stability of the seawall is not strong enough to endure severe weather conditions.</li> <li>• The understanding of coastal processes, of physical (e.g. influence on the currents) and biological origin may still have some blind spots.</li> <li>• Although it is not standing water, it may need cleaning from algae.</li> <li>• The fact that it is in a marine environment, makes it more difficult to deal with potential accidents (motor oil spills) or diseases, epidemics, e.g. bird flu.</li> <li>• Difficulty of cleaning and repairing broken (corrosion?) turbines in the marine environment.</li> <li>• Limits commercial shipping and navigation so may not get government approvals (meaning extra harbours need to be built on either side of the lagoon – instigating/initiating unplanned and unforeseen developments).</li> </ul>
<p><b>Opportunities</b> – are external elements that the project could use to its advantage</p> <ul style="list-style-type: none"> <li>• Increasingly stringent government regulations on greenhouse emissions favour clean energy.</li> </ul>	<p><b>Threats</b> – are external elements that could cause difficulties for the project</p> <ul style="list-style-type: none"> <li>• A change in government policy could undermine the economic viability of the project.</li> </ul>

- Society now expects new power plants will be non-polluting, favouring power plants such as the new type.
- Maximizing return on investment by developing associated aquaculture (lobster and oyster hatchery, edible seaweed, cockle and mussel farming and further development work around Integrated Multi-Trophic Aquaculture (IMTA) – a way of a number of different species living together for environmental and economic benefit), also creating new jobs.
- Establishing good relations with the local community by developing recreation (walks on the wall, cycling, running, playgrounds, sporting events, angling, swimming, canoeing, rowing and sailing), tourism, edutainment and environmental projects.

- Changing self-regulatory environment to totally human-controlled environment can backfire on many unpredictable levels and scales.
- Severe weather conditions may damage the seawalls.
- Negative changes to the environment (such as to coastal processes, water quality, flooding and hydrology, intertidal and subtidal benthic ecology, fish, marine mammals, birds, terrestrial ecology, seascape and landscape, heritage, salinity, sedimentary deposits) may lead to government fines and loss of community goodwill.
- Natural hazards like earthquakes, tsunamis etc.

## Section E: Soil Degradation

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3 m

1. Describe 3 functions of soil.

Answer (point marking – 1 mark for each correct function):

- Fungi and bacteria in the soil recycle dead plants and animals into nutrients needed by all living things.
- It is a medium for plant growth, providing plants with support, essential nutrients, water and air. Plant life, in turn, supports animal life.
- It acts as a reservoir for water, influencing the quantity of water in our rivers, lakes and aquifers.
- It has a filtering and transforming role for materials added to the soil. Thus, soil is often able to protect the quality of our water and air.
- It provides a habitat for organisms. A handful of soil may be home to billions of organisms, belonging to thousands of species.
- It provides raw materials such as clays, gravels, sands and minerals as well as fuels such as peat.
- It also provides a physical base for the foundations of buildings and roads.
- Natural hazards (forest fires, volcanic eruption, tsunami...).

2 m

2. Identify 4 **natural** causes of soil degradation.

Answer (point marking – 0.5 marks for each correct natural cause):

Different physical factors can contribute to different types of soil erosion (soil detachment, movement and deposition) changing the natural composition and structure of the soil by wearing away the fertile topsoil layer as well as organic matter.

- Rainfall erosion,
- Surface runoff,
- Floods,
- Wind erosion.
- Mass movements.
- Drought.
- Salinization by mineral weathering.
- Volcanic activity.

2 m

3. Identify 4 indicators that signify soil degradation resulting from **human actions**.

Answer (point marking – 0.5 marks for each correct indicator):

- Decline in structural condition,
- Loss or displacement of the fertile topsoil layer,
- Loss of organic matter,
- Depletion of soil nutrients,
- Decline in soil fertility,
- Lessened aeration,
- Interfered water holding capacity,
- Soil crusting, sealing and compaction decreasing the infiltration of water into the soil,
- Overload of toxic chemicals (from municipal or industrial (radioactive) wastes, (airborne) pollutants (oil spills), artificial fertilizers, pesticides, insecticides, herbicides called chemical deterioration),
- Adverse changes in salinity, acidity or alkalinity,

- Overgrowth or lack of bacteria and fungi impacting the microbial activity of the soil through bio-chemical reactions.
- Salt crust forming.

4 m

4. Study Resource Booklet Figures E1 and E2: Photos of examples of soil degradation. Name and explain the soil degradation processes.

Answer (point marking – 0.5 marks for each correct process and level marking – 1.5 marks for each well elaborated explanation, 1 mark for each satisfactorily and 0.5 marks for poorly elaborated explanation):

- Figure E1 process: Salinization.
  - Explanation: **Irrigation** salinity occurs due to increased rates of water moving down past the root zone and recharging the **groundwater, causing the water table to rise**. Rising water tables (capillary action) bring mineral salts into the plant root zone (topsoil). The salt remains behind in the soil when water is taken up by plants or lost to **evaporation**. Inefficient or outdated irrigation and drainage systems increase the amount of water moving down past the root zone. Poor water distribution in the irrigated area results in some areas being **under-irrigated**, causing salts to accumulate (where water tables are high) because the salts are not flushed out. Other areas can be **over-irrigated and waterlogged** (a field covered in salt deposits). The soil is basically saturated but water is still being irrigated from rivers meaning that there is little to no infiltration into the soil i.e. the water table is very high to the soil surface. Salinization reduces yields.
- Figure E2 process: Desertification (overgrazing, vegetation clearing).
  - Explanation: It happens when the soil is no longer able to support further growth of vegetation and is irreversible. This is caused by the over intensification (**exploitation**) in cultivating the soil by **grazing** (animal husbandry, livestock), **tillage** or **deforestation** (fuelwood collection) leading to the **removal of the land's stabilizing vegetation cover**, the little topsoil that is present is also easily eroded away by wind and water, causing the cycle of degradation (leaving only the less-biologically-active lower-soil-layers, which are often then subsequently baked dry and hard in the sun). Since soil needs to replenish itself through the decomposition of plants and weathering of rocks, with land not lying fallow, nutrients cannot be replenished.

5. Study Resource Booklet Figures E1 and E2: The photos of the examples of soil degradation. Outline measures that could **reduce the severity** of both types of soil degradation.

Answer (level marking – 2 marks for one well elaborated measure or actions and 1 mark for poorly elaborated measure or actions):

- Measures for figure E1: Removal of salt from soil and introduction of modern irrigation methods such as subsurface or drip irrigation.
  - Prevention of high rate of evaporation, which is very cost intensive.
  - Apply leaching fraction: additional water to be used periodically to flush down salts (leaching) from the surface away from the root zone, after calculating the amount of salt needed for plants to grow.
  - Avoid building dams near areas where the water table is high, so as to reduce the situations of having concentrated salty water near the surface, which contribute to salty surfaces during dry seasons when capillary action takes place.
- Measures for figure E2: Restoration actions range from on-the-ground activities such as habitat protection, assisted natural regeneration, sand-dune stabilization and tree-planting to policy improvements, the provision of financial incentives, capacity development, and continuous monitoring and learning. To be effective and sustainable, restoration should be approached at the landscape scale.
  - Conservation farming and land management which may involve regulating the areas and frequency in which land is cultivated and grazed on, to ensure that there is:
    - A period in which the area is unused to give vegetation a chance to settle again (ground lies fallow),
    - Introduce fertilizer to the land, to allow for the replenishment of nutrients,
    - Vegetation cover never entirely removed,
    - Then balance between number of cattle and available pastures.

## Section F: Food Security

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2 m

1. Study Resource Booklet Figure F1: The trajectory of undernourishment in developing regions: actual and projected progress towards the World Food Summit (WFS) and Millennium Development Goal (MDG) targets.

Describe the **progress made** in achieving the World Food Summit (WFS) and the Millennium Development Goal (MDG) targets.

Answer (point marking – 1 mark for each correct description):

- The World Food Summit (WFS) target was not reached. The number of undernourished people fell from 991 million in 1990–1992 to 780 million in 2014–2016, whereas the target was just above 500 million (the target was to halve the number of undernourished people).
- The Millennium Development Goal (MDG) target was almost reached as the prevalence of undernourished people fell from 23.3% in 1990–1992 to 12.9% in 2014–2016, not far above the target (of 11.65%) (the target was to halve the percentage of undernourished people).

1 m

2. Study Resource Booklet Figure F1: The trajectory of undernourishment in developing regions: actual and projected progress towards the World Food Summit (WFS) and Millennium Development Goal (MDG) targets.

Suggest the main reason why there was a **difference** in meeting the 2 targets.

Answer (point marking – 1 mark for the correct reason):

Although the prevalence of undernourished people nearly halved, the increasing global population meant that the number of people did not halve.

Although the prevalence of undernourished people nearly halved, the increasing population in developing countries meant that the number of people did not halve.

Although the prevalence of undernourished people nearly halved, high birth rates (accompanied by low death rates) in developing countries meant that the number of people did not halve.

3. Study Resource Booklet Figure F2: Nine influences on food security.

Select 2 of the categories in the following list (Environmental, Political, Social/Cultural and Economic) and with the help of the information provided explain how factors in each category contribute to the causes of **food insecurity**.

Answer (level marking – 2 marks for one well elaborated explanation and 1 mark for poorly elaborated explanation):

- Environmental:
  - Climate change – crops not adapted to changing conditions, less food produced (also increases prices); unpredicted weather; intense and widespread droughts and storms – lower crop yields
  - Land degradation – land becomes less productive – less food produced.
  - Soil pollution – less land available for farming and cattle breeding
  - Increase in acidity of soil due to heavy rains
  - Natural disasters – destroys crops/livestock and farming infrastructure (so less food produced), destroys livelihoods (so cannot afford food).
  - Drought – rain-fed agriculture vulnerable to periods of drought.
  - Decrease in global seed diversity – crop production more vulnerable to weather
  - Extinction of some crops suited for certain climate types
  - Scarce weather stations – missing information on weather (both environmental and economic factor)
  
- Political:
  - Conflict/war/political instability – farmers flee, crops/livestock destroyed.
  - Governments not giving priorities to financing agricultural infrastructure (irrigation, safe storage and transport, etc.).
  - Agricultural research not funded in budgets.
  - Small farms appropriated for urban expansion – pushing farmers to more marginal lands.
  - Lack of emergency food provision.
  
- Social/Cultural:
  - Food preferences changing to meat – producing meat is less efficient use of resources.
  - Resistance to changing traditional farming practices to more sustainable options.
  - Gender inequalities reduce access to land ownership and loans.
  - Class differences – “the untouchables” are not allowed to own land and houses
  - Low rate of insured crops – poverty in case of destroyed crops or lost yields
  - Low health insurance rate – in the case of illness people cannot afford themselves health treatments and cannot work in agriculture
  
- Economic:
  - Poverty (low household income) – cannot afford to buy food.
  - Local food crops replaced by export crops/biofuels – less food produced locally (also increases prices).
  - Rising cost of inputs such as seed and fertilizer.
  - Increase in food prices – growing gap between the rich and the poor that cannot afford the food
  - Low access to education – inability to improve agricultural productivity
  - Low world grain reserves - inability to cover the shortages in case of hazards
  - Low international aid (from developed to developing countries) to adapt to climate changes
  - Work in agriculture as hired workers for international companies – low income and no individual agricultural production to feed the families



4 m

#### 4. Outline 2 strategies to eliminate hunger.

Answer (level marking – 2 marks for one well elaborated strategy and 1 mark for poorly elaborated strategy):

- Working together, governments, international aid agencies and non-government organizations could:
  - Invest more in agricultural research to develop crop varieties that would increase food production, e.g. higher yielding crops. Crops can be more resilient to drought conditions, countries where hunger is still a concern often suffer from extreme climates.
  - Set up micro-finance schemes for loans to farmers, including women. This would allow farmers to buy machinery/fertilizer/etc. to increase production, or to buy seed after a bad harvest when they have had to eat all their saved seeds.
  - Finance the development of irrigation schemes so that farmers are not reliant on rainfall. Sustainable solution they could then grow a greater quantity of food, and also a greater variety of food.
  - Invest in more efficient and effective storage of food at a local and regional level, and of its transport. This would save a lot of food that is currently wasted through vermin, insects, water, etc.
  - Develop agricultural extension programmes so that small-scale farmers can benefit from current information on sustainable farming practices in a changing climate.
  - Establish stable fair-trade networks so that small scale farmers have increased markets for their products and can increase their income, making them less vulnerable to food insecurity.
  - Introduce school meals so that children, who are vulnerable to malnutrition, get a regular supply of nutritious food.

4 m

#### 5. Discuss why food waste is high in developed countries.

Answer (level marking – 4 marks for excellently elaborated discussion, 3 marks for fully, 2 marks for satisfactorily and 1 mark for poorly elaborated discussion):

- Attitudes in developing countries – fussy and particular about food presentation and what it looks like.
- Buying and consuming too much.
- Wealthy people can afford to waste food.
- Greater calorie consumption leading to buying more food.
- Life style.
- The power of advertising and the consumer mentality.
- Pre-packaging of products so that one buys more than needed.
- The sense of complacency – not recognizing the effort involved in food production as one just goes to the supermarket.
- Also a sense of complacency because most people in developed countries have never experienced hunger.

Notes